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THE Malayan Agricultural Journal.

JANUARY, 1932.

EDITORIAL.

Tea

Attention is directed to a review included in this number of a report by the Imperial Economic Committee on the subject of the preparation for market and marketing of tea.

The tea industry, in common with most other agricultural products, has suffered from the present general trade depression. The situation has been aggravated by an increase of production and, from the point of view of the Empire producer, from the competition of the Netherlands East Indies.

Interest in tea cultivation has widened in Malaya during the past few years, due in part to the development of Cameron Highlands, but also, be it noted, to the increased area planted on the plains.

In view of the economic crisis which still faces the tea industry, one may well consider whether the Malayan pioneers of tea production are justified in their optimism, or whether the result of their enterprise is likely still further to increase the world's stocks of surplus tea.

For an answer to this question one may turn once more to the report under review. We are there told that good quality tea has always commanded a remunerative price and we should here urge therefore the paramount necessity for local tea growers to concentrate their attention on quality rather than on quantity, if their object is of dispose of their crop on the London Market.

The report further emphasises the importance of careful manufacture in the production of high quality tea. Whether the tea be upland or lowland, the quality of the product can be influenced during the process of manufacture. In this matter, Malaya should be able to hold its own. Producers have ample opportunity of studying and taking advantage of the experience of our near neighbours—India and Ceylon. It is stated that tea production in those countries has made notable progress in the past ten or twenty years. It is perhaps advisable that former tea planters now in Malaya and who are once more interested in this commodity should pay due regard to developments in this direction which have been adopted in India and Ceylon since their tea-planting days. The influence of these practical men, backed by a knowledge of modern tea factory methods, should prove of great value at the present juncture of tea production in Malaya.

The Department of Agriculture, S.S. and F.M.S. last year sent an officer to Ceylon and India to report on the present methods of tea cultivation and manufacture. His report will shortly be sent to press and will be available to the public in 1932.

One further aspect of this question remains for consideration. The report stresses the wide field for the development of tea consumption in the countries of production. We have to ask ourselves whether there is room for further consumption of tea in Malaya, and whether local production will be in a position to satisfy or stimulate such a demand.

The net imports of tea into Malaya in 1930 exceeded 8,700,000 lbs. Our *per capita* tea consumption is therefore 1.99 lbs. per annum. This, in comparison with most countries outside the United Kingdom, the Irish Free State and the Dominions, is high. It must be remembered, however, that nearly 40 per cent. of the population of this country are Chinese who are consistent tea drinkers. Other local nationalities also favour this beverage. The object of the Malayan tea producer should therefore be first to market a class of tea which finds local favour rather than some other grades said to be suited to some problematical and distant market.

The market for locally produced tea is at our doors and is capable of extension and we feel that local producers are assured of a market in this country if they concentrate their attention from the start on the quality of tea for which there is a demand in Malaya.

Fruiting Ability of Oil Palms.

Little doubt is now entertained regarding the adaptability of the oil palm to plantation conditions. The crops of oil and kernel now being obtained on oil palm plantations, both in this country and in Sumatra, have fully justified the opinion held by the pioneers of the industry, that the yields, quality of oil and working costs of palms produced under estate practice would compare favourably with the product obtained from the areas of indigenous palms in Africa.

The estimate of the average yield from mature palms in Malaya was stated in Bulletin No. 39 "The Oil Palm in Malaya", published four years ago, to be 16 cwt. of palm oil and 4 cwt. of kernels per acre per annum. Experience since that date shews that as a working basis, these figures still hold good. Some local oil palm estates are at present unable to reach the average while others have obtained yields much in excess of these figures. In one case, for instance, an annual yield of one ton of oil is recorded.

Such variations as occur may be due to variety of palm cultivated, local conditions of soil and drainage, or to systems of cultivation, manuring, artificial pollination and harvesting adopted. It is, of course, probable that all these factors are concerned, and it is only by the continued study of yields in relation to such factors that the ideal conditions may be attained.

In this number, Dr. Jack contributes an article on the "Variation in Fruiting Ability of Oil Palms", which supplies evidence concerning the variation in yield of individual palms. He shews that the variation is very considerable, being 47 per cent., which means that a very large proportion of the crop is obtained from a relatively small percentage of the palms. From individual tree records of crops he demonstrates that 25 per cent. of the total population of trees produced only 11 per cent. of the crop. It is therefore highly desirable in planting up an area, as far as possible to guard against the inclusion of the progeny of poor-yielding palms. Further, a study of individual tree records on poor-yielding blocks may, in some instances, lead to a consideration of the advisability of re-planting certain sections with selected seedlings in order to increase the general average of the particular field.

Storage of Coconuts.

In an article on this subject, Mr. F. C. Cooke, Assistant Chemist for Copra Research, describes the system obtaining in Ceylon of storing coconuts for some time before using them for copra production. From his trials in Malaya of this system he draws conclusions of definite value to Malayan copra producers.

It must be remembered that Ceylon is in the enviable position of being recognised as the exporter of the finest quality of copra in the market and a close comparison of Malayan methods with those of Ceylon is therefore indicated if any serious attempt is to be made to improve the quality of our exports of this product.

The blind acceptance of the Ceylon system of copra production for application in Malaya is not to be contemplated, because there are considerable differences in climate and soil and in method of marketing.

The author states that while the Ceylon system of picking and storing green nuts is not recommended for Malaya, it might be employed with advantage in the case of the produce from such small holdings as find it necessary to pick nuts in a green condition as a precaution against theft.

Rubber Statistics for the N. E. I. 1930. A review of *The Export Crops of the Netherlands East Indies in 1930* was published in the last number of this Journal.

The publication reviewed is in the Dutch language, but the tables are generally intelligible to English readers as the headings are all printed both in the Dutch and English languages.

Through the courtesy of the American Trade Commissioner, Singapore, we have received a copy of an English translation of the somewhat lengthy portion of the Report which deals with rubber.

This valuable translation is too long for inclusion in this Journal and further abstract or review would be of little value to the student of the rubber position. Copies of the translation may, however, be seen in the respective offices of The American Trade Commissioner, Singapore, the Director of Agriculture

at Kuala Lumpur, the Director, Rubber Research Institute of Malaya, Kuala Lumpur and of the Registrar-General of Statistics at Singapore.

Oil Palm Machinery

The Department of Agriculture, S.S. & F.M.S. has now published in the pages of this Journal accounts of several types of machinery employed for the production of palm oil and palm kernels on a large scale.

The principal types described are as follows :—

The centrifugal extraction plant made by Messrs. Manlove, Alliott and Co. Ltd., for whom Messrs. William Jacks and Co. (Malaya) are the local representatives, and the press installation, comprising stirring kettle, hydraulic press and pump by Messrs. Gebr. Stork and Co., for whom Messrs. Guthrie and Co. Ltd. are the local representatives. The experimental plants of the above makes, installed at the Government Experimental Plantation, Serdang, are described in Vol. XIX, No. 8. A more detailed description of the latter machinery is contained in Vol. XVIII, No. 10, under the title of "The Palm Oil Factory at Elaeis Estate, Johore".

The Krupp machinery for the extraction of palm oil, for which Messrs. Boustead and Co. Ltd. are the local agents, is described in Vol. XIX, No. 11, under the title of "The Production of Palm Oil on a Large Scale".

These accounts have been published for the information of those interested in oil palm manufacture. No one type of machinery has been recommended in preference to another, the object being rather to present to readers detailed information of the different types from which they may arrive at a decision of the type most suitable for their individual needs.

THE STORAGE OF COCONUTS AFTER HARVESTING

BY

F. C. COOKE,

Assistant Chemist for Copra Investigations.

Introduction.

The storage of coconuts after harvesting appears to be a practice which is followed exclusively in Southern India and Ceylon. Sampson, in referring to coconut storage, states that coconuts¹ which have been stored give the best quality of copra. At the same time, he qualifies this statement by declaring that the best plan² is to pick coconuts before they are ripe or dead-ripe and, should there be any doubt as to the condition of ripeness, that it is much better to pick the nuts before rather than after they are dead-ripe.

Rajapakse³ describes experiments performed in Ceylon in which 120 coconuts were stored in a room and a similar number in the open. Ten coconuts were taken for conversion into copra monthly and the results shew that over 12 months, the yield from the coconuts stored in the room was constant, but that the yield of copra from those stored in the open declined after 4 months. In view of the small number of fruit examined on each occasion, the results cannot be regarded as conclusive.

Coconut Storage in Ceylon.

The writer paid a visit to Ceylon in July, 1931, to determine among other things the origin of the practice of coconut storage and to ascertain whether its adoption could be recommended to Malayan producers of copra, since the results of experimental work in Malaya were apparently unfavourable to the adoption of this procedure.

Coconut Harvesting.—It was found that, owing to local conditions, coconuts on the west coast of Ceylon generally fell in a greenish condition. Furthermore, for every green bunch that fell naturally, another bunch of still greener nuts was usually cut down. Even though the coconuts which have fallen will change in colour while waiting to be picked up, 90 per cent. of the nuts in the mixed crop, as received at the storage depôt, were not fully brown.

The copra obtainable from such a crop, under Malayan conditions of production, would be rubbery, wrinkled or testaless. The pieces would usually be distorted and fractured and would have a pale yellowish coloration. Furthermore, in Malaya,⁴ green unripe nuts only give an average yield of .43 lbs. of

Sampson, *The Coconut Palm*. (1) p. 220, (2) p. 70; (3) Rajapakse, *Tropical Agriculturist*, April 1918 p. 214..

⁴ Cooke, *Malayan Agricultural Journal*, October, 1931, p. 477.

copra, while the normal yield for dead-ripe brown nuts is .50 lbs. of copra per nut.

In Ceylon the fruit is invariably collected and transported whole and unbroken. In this way, the copra is kept free from bits of husk and dirt and from exposure to bacterial attack which might set in during the period of transport, and which would then produce the red-brown colour seen on carelessly-prepared copra.

The Storage Dépôt.—Usually the bunches are brought into a central dépôt in carts, and the loads are dropped on to the ground without any attempt at sorting, stacking or separation of the coconuts from the bunch. Sometimes, where armed watchmen are kept and the estate is surrounded by barbed wire, there are several dépôts, or the main dépôt is moved from place to place.

It is claimed that palms in the neighbourhood of a storage dépôt are improved, provided the dépôt is not kept too long in one place, since the underlying grass is killed and converted to humus and a certain amount of mineral matter is washed by rain from the decomposing husk.

The establishment of a permanent store in one place, particularly on heavy soils, is not good, since air is permanently excluded from the roots of the palm, damp or muddy conditions are induced in the soil and sour fermentation takes place. On one well kept estate, the only trees with yellow foliage were in the neighbourhood of the permanent central storage dépôt.

Method of Storage.—The fruit is almost always stored unhusked, though a few middleman producers who purchase coconuts in small lots from small owners, store them in sheds in the husked condition.

In certain instances, where the crop includes a fair percentage of fallen brown fruit it is considered to be worth while, in order to avoid possibility of serious germination of the browner coconuts during the period of storage, to sort and to store only those that are green. The practice of selective storage if applied where necessary in Malaya, would doubtless assist materially towards improved quality, since the production of low grade copra from unstored green coconuts would thereby be avoided.

A heap of stored nuts covers a very extensive area, its height being generally about 3 feet and it is usually covered with palm leaves. If the coconuts are stacked higher instead of merely being dropped from the carts, the work becomes slower. On one 600 acre estate, for example, instead of 15,000 coconuts being brought in daily, only 10,000 would be handled. Furthermore, if the coconuts are heaped to a height of 6 feet, the underlying soil is compressed, the heap sweats on account of lack of ventilation and the fruits are more liable to germinate.

The number of coconuts so stored naturally depends primarily on the size of the estate and on the storage period. The latter is normally one month, but it may be slightly reduced for financial reasons or during a period of favourable copra prices. On the other hand, the period of storage may be considerably extended if the weather is too wet to make good copra or in expectation of an

improved price. A 1,000 acre estate would keep an average stock of about 500,000 coconuts.

When prices are steady, the fruits can be taken from the depôt to the kilns at a steady daily rate irrespective of crop fluctuations. This makes it possible to employ the same labourers continuously on drying so that speed and efficiency are uniformly maintained, the kilns are never out of use and never cool, fewer or smaller kilns are employed, and consignments of copra can be despatched regularly.

Changes during storage.—The meat of a stored green nut is less sweet, harder and more fibrous than that of the unstored green nut, indicating that changes occur during storage. When green nuts are stored in Ceylon, the haustorium visible after storage rarely exceeds pea size, and advanced germination is found only after about six months. If the nuts are picked too immature, they spoil with storage and conversely, ripe nuts germinate in storage. It is essential, therefore, that collection shall be regular and thorough.

While it was suggested by one or two producers in Ceylon that the oil and copra content of green coconuts will improve on storage, experimental work does not confirm this impression.

THE ADVANTAGES RESULTING FROM COCONUT STORAGE IN CEYLON.

The advantage resulting from the storage of the green coconuts harvested in Ceylon, may be summarised as follows:—

- (1) Husking is made easier, green unstored coconuts being very difficult to husk.
- (2) Shelling is cleaner and easier, since the brown skin of the coconut meat does not adhere to the inside of the shell, as it otherwise would do.
- (3) The resulting shells are dry, hard and husk free, and when used as fuel, they burn continuously and with the production of little smoke.
- (4) Copra can be dried at a constant rate, irrespective of crop fluctuations, thus:—
 - (a) fewer or smaller kilns are used;
 - (b) the same labourers are in constant employment;
 - (c) standard drying procedure is assured.
- (5) If necessary, the production of copra during prolonged spells of wet weather may be suspended.
- (6) Additional copra may be prepared when high prices are ruling, and if this practice is general, it provides a local price stabiliser.
- (7) As the green coconut matures and turns brown, the contained meat and its brown skin (testa) hardens thus:—
 - (a) The production of leathery, wrinkled, testaless and mis-shapen or coloured copra is reduced from about 15 per cent. to about 1 per cent.

- (b) Smooth, white, round (i.e. not triangular) opaque copra is obtainable (if slow drying is practised).
 - (c) Since hard wet meat appears to offer greater resistance to bacterial sliming than the softer wet meat of unstored green nuts, only where there is extreme carelessness is coloured copra to be seen.
 - (d) A uniform raw material may be expected to and does produce a uniform quality of copra.
- (8) The extensive heaps of stored nuts kill the underlying grass.

Coconut Storage Experiments in Malaya.

In view of the good quality of Ceylon copra and the high price which that copra commands in the European market, the subject of coconut storage has been given considerable attention in order to determine.—

- (1) Whether the practice would give improved yields of copra in Malaya;
- (2) Whether, if the practice were generally adopted, the percentage oil content and the quality of Malayan copra would also improve.

Method.—A series of seven groups of large scale experiments was conducted on six different estates adopting a storage period of one month. In the course of the work, a total of 4,400 coconuts was used.

Since the fruits were collected promiscuously and since the methods of copra preparation on each estate do not provide standard conditions the results recorded in Table IV on close examination reveal a few minor irregularities that are absent in Table V, which is the record of the picked crop sorted and stored from a selected area on a single estate.

Experimental Conclusions.—The results of coconut storage for one month are as follows:—

- (1) Colour changes in the fruit and nut.

Table I.
Physical Changes Compared.

Before Storage.		Method of storage	After Storage.	
Fruit.	Nut.		Fruit.	Nut.
Wholly green coconuts	White to brownish yellow with adherent husk.	In shade	Shriveled, cracked, and brown	Clean brown
		In sun.	Very light brown	Clean brown
Wholly brown coconuts.	Clean brown.	In sun.	Bleached, light grey, sprouting.	Wet brown.
		In shade.	Brown and sprouting.	Clean dark brown

It will be seen that coconuts appear to mature in storage.

(2) Germination in Storage.

Table II.
Ripe and Unripe Coconut Storage.
Comparison of Spoilage.

Before Storage.	Method of storage.	After Storage.				Spoilage per cent.
		Number rotten.	Number un-germinated.	Number germinated.*		
				pea to 2"	2" upwards	
50 wholly green coconuts.	In sun	3	5	42	0	6
	In shade.	3	14	33	0	6
50 wholly brown coconuts.	In sun	6	2	18	24	60
	In shade.	5	3	14	28	66

* The dimensions given refer to the diameter of the enclosed haustorium or "apple".

It will be seen that green coconuts do not germinate to any great extent during one month of storage.

(3) Rotting in Storage.

In one area inspected, meat development within the nut was poor and nut rotting was rather common. Here green coconuts rotted to the same extent in storage as when left to ripen on the palm.

Table III.
Green Coconut Storage.

Table showing that spoilage is not emphasised when green coconuts are stored.

Groups of 300 coconuts.		Number spoiled.		Rejections per cent.
		Rotten	Corroded and discoloured.	
1. Green unstored	...	2	9	3.7
2. Brown unstored	...	5	18	7.7
3. Green stored	...	2	21	7.7

(4) The effect of storage on yield.—

There appears to be no increase in contained oil and copra if coconuts in any condition of ripeness are stored for one month. On the contrary, the yields of both are actually slightly reduced. Therefore, since unstored green coconuts ordinarily yield in Malaya much less oil and copra than unstored brown

coconuts and since the effect of storage will be to reduce the yield still further, the picking of green coconuts and subsequent storage is not recommended to copra producers in this country.

Table IV.
Nut Storage Experiments on 5 Estates.
Comparative Yields of Oil and Copra per 100 nuts for Unripe and Ripe Nuts, and Unstored and Stored Nuts.

Estate	Groups of 100 nuts	"Dry" Copra obtained (lbs)		Oil percentage (Dry Basis)		Total Oil (lbs)	
		Green unripe	Ripe brown	Green unripe	Ripe brown	Green unripe	Ripe brown
A	Unstored	37	48	69.1	65.2	26	31
	Stored	34	44	66.5	67.8	23	30
B	Unstored	48	60	67.8	64.7	33	39
	Stored	48	54	66.2	67.9	32	37
C	Unstored	47	56	67.5	65.2	32	37
	Stored	47	53	66.7	65.2	31	35
D	Unstored	41	44	66.8	63.9	27	28
	Stored	40	41	66.7	64.9	27	27
E	Unstored	42	43	61.9	62.3	26	27
	Stored	39	43	63.9	66.9	25	29
Average	Unstored	43	50	66.6	64.3	29	32
	Stored	42	47	66.0	66.5	28	31

On each estate, the nuts were collected promiscuously.

(5) Changes in the percentage oil content.—

There would appear to be some tendency towards an increase in the percentage oil content of the resulting copra, when coconuts are stored.

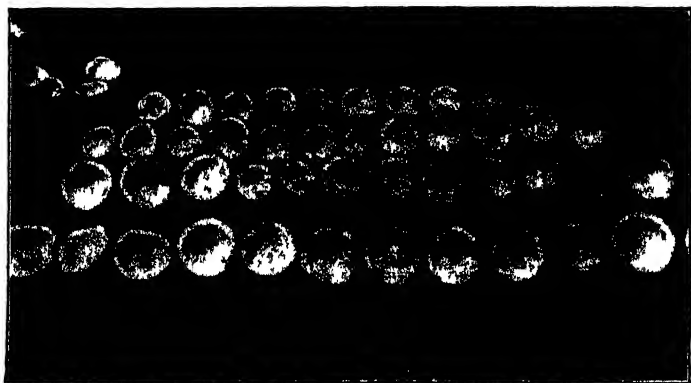
When the storage of brown coconuts is practised, the loss of copra is most marked, though the remaining copra becomes progressively richer in oil as erosion through germination proceeds, owing to the existence of the oil gradient in the



GREEN COCONUT STORAGE IN CEYLON
AN OUTLYING DEPOT.

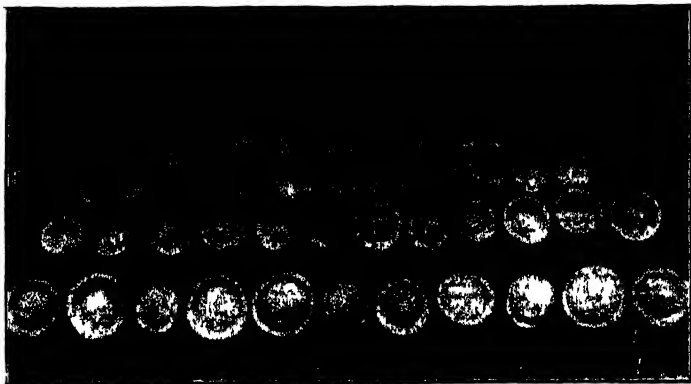


GREEN COCONUT STORAGE IN CEYLON
A CENTRAL DEPOT OF 500,000 NUTS.



UNRIPE GREEN COCONUTS AFTER ONE MONTH'S STORAGE.

Note : No advanced germination



RIPE BROWN COCONUTS AFTER ONE MONTH'S STORAGE.

Note : Discoloured and Rotten Nuts

white endosperm⁵ On no account, however, is brown coconut storage to be recommended.

Table V.

Comparative nut storage experiments conducted on one estate.

(800 picked nuts examined)

The effect of storing nuts of different degrees of ripeness.

Estate F.

200 nuts stored for one month and then kiln-dried.	"Dry" copra per nut (lbs.)		Oil per cent. (Dry basis)		Total oil per nut (lbs.)	
	Before storage	After storage	Before storage.	After storage	Before storage.	After storage.
Wholly green but fully developed nuts.	Average 0.53 lbs.	Average 0.52 lbs.	65.7	67.7	Average 0.53 lbs.	Average 0.53 lbs.
Partially green nuts, turning red brown.	0.59 "	0.59 "	64.9	66.6	0.38 "	0.39 "
Red brown nuts nearly ripe.	0.60 "	0.56 "	64.3	67.8	0.39 "	0.38 "
Fully brown unsprouted nuts.	0.60 "	0.54 "	64.7	67.6	0.39 "	0.37 "
Mixed Crop (average).	0.58 lbs.	0.55 lbs.	64.9	67.4	0.38 lbs.	0.36 lbs.

(6) The effect on quality.—

Unless they are severely under-ripe, the storage of green coconuts results in the production of copra equal in quality to that produced from unstored ripe brown coconuts, under similar conditions of careful preparation.

If green coconuts are not stored, the copra then obtainable will be of poor quality, since as stated previously, a large percentage of wrinkled, discoloured, testaless and rubbery pieces will be found.

In small holdings, if owing to the fear of theft, two out of every three nuts are collected in a green unripe condition, in order to avoid the production of unsightly copra, it is strongly recommended that selective storage should be applied. Thus, while the wet meat from the ripe brown coconuts may be converted to copra at once, the green coconuts should be set aside and stored for one month, so that they may mature.

It must be clearly understood that this recommendation is one of expediency and that on estates, it is better to harvest as few green coconuts as possible in order that optimum yields of copra may be obtained.

The Cost of Coconut Storage in Ceylon.

While, owing to the high standard of excellence of Ceylon copra, due to the

5, Cooke, *Malayan Agricultural Journal*, March, 1931, p. 131,

careful method of preparation practised by the large majority of producers, the product is able to command a premium of about 75 cents a picul over Straits No. 1 copra, this advantage is partially offset by the necessity for coconut storage in order that high quality may be made possible, under the conditions prevailing.

A well-managed Ceylon estate is selected to provide an example :—

Area	1,000 acres.
Annual crop	4,000,000 nuts (approx.) or 13,000 piculs of copra.
Average number nuts in storage	500,000 nuts.
Storage period	1½ months.
Cost of bullock transport	17 cents (Straits) a load.
Bullock cart loads	(a) 2,000 husked nuts. (b) 500 whole coconuts.
Transport from the field to the central dépôt for	
2,000 whole coconuts	costs 67 cents.
2,000 husked nuts	„ 17 „
	—
Extra cost of transport :	50 cents. (Straits) per
	= 2,000 coconuts.

Therefore the cost of green coconut storage on this estate is made up as follows :—

(1) Additional transport charges on	\$	per annum
4,000,000 nuts as above	1,000	
(2) Probable loss of copra due to collecting		
90 per cent. unripe nuts (at 1,250 piculs		
of copra lost) =	6,250	

Total cost of coconut storage per annum \$7,250

This represents an additional charge of 56 cents a picul.

Other financial considerations.—The cost of husking Ceylon coconuts is reduced very considerably after they have been matured by storage since green coconuts, as normally harvested there, are extremely difficult to husk, thus :—

Husking Speed.

Green unstored nuts	...	500 nuts per man per day
Stored nuts	...	2,000 nuts per man per day

In addition, allowance must be made for the fact that regular and efficient working at the kilns is probable, since the same attendants are in continuous employment and finally, since additional copra can be made when prices are high, coconut storage operates as a local price stabiliser.

Conclusions.

It would appear :—

- (1) That the copra obtainable from green coconuts after storage would be equal in appearance to that obtainable from correctly harvested brown coconuts;
- (2) That the copra obtainable from unstored green coconuts would contain a high percentage of unsightly copra (wrinkled, discoloured, testaless and rubbery) under similar conditions of preparation;
- (3) That where the fruits fall in a ripe brown condition and where care is taken only to harvest coconuts that are fully brown and ripe, the highest possible yields of oil and copra would be obtained, whereas reduced yields of oil and copra would result if green coconuts were harvested, either for subsequent storage or for immediate preparation of copra;
- (4) That coconut storage is, however, necessary where the fruits fall naturally in the green unripe condition, or need to be so collected, otherwise irregular drying and poor quality results;
- (5) That coconut storage is therefore necessary in Ceylon and that it is partly responsible for the uniform and good quality of Ceylon copra since a uniformly matured and clean raw material is thereby handled at the kiln;
- (6) That where it can be avoided, as on those Malayan estates where careful fruit harvesting is practised and where the percentage of unripe coconuts present in the mixed crop is negligible, coconut storage is not to be recommended;
- (7) That it is inadvisable for Malayan estates to adopt green coconut harvesting with subsequent storage for one month, in imitation of Ceylon practice owing to reduced yields that would result;
- (8) That where a large percentage of unripe fruits is normally included with the crop (e.g. in native small-holdings) those coconuts that are markedly unripe should therefore be picked out and set aside to mature for one month. In this way the possibility of an irregularly dried and unsightly product is lessened, and copra of uniform dryness and quality may, if other conditions are satisfactory, be readily obtained.

VARIATION IN FRUITING ABILITY OF OIL PALMS

BY

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AND

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The oil palm in common with fruit trees generally, exhibits a wide variation in the amount of fruit produced by individual palms. In Malaya, attention was first given to the study of variation in cropping of this palm at the Government Experimental Plantation, Serdang, where in 1924, records of the fruiting ability of individual palms were made on an avenue of 86 palms which were planted in May 1922. The 43 palms on each side of the avenue were spaced 30 feet apart while the south side of the avenue was 36 feet distant from the north side.

The palms forming the south side of the avenue were artificially pollinated (one bunch per month) from August 1924, while the palms on the north side were left for pollination by natural means. A comparison of the resulting fruit yields in 1925 published in 1926 by Milsum and Curtler⁽¹⁾ showed that five times as much fruit was produced by the palms which had been artificially pollinated as was produced by the control palms and that the individual yields per palm varied from practically nothing up to 161 lbs. of fruit.

The same palms were under observation in 1926 and the records taken in that year and in 1927 by Marsh⁽²⁾ and⁽³⁾ confirmed the results found in 1925 and showed that marked variation in individual yields per palm occurred with these comparatively young palms growing under avenue conditions. It seemed desirable that the range of variation under ordinary plantation conditions should be investigated to provide data for selection of high yielding palms on a much wider scale than that afforded by the avenue grown palms at Serdang. In consequence, the following notes have been derived from a study of a block of 589 palms growing in a square block on a local estate (Elmina) under good average conditions. The chief aim of this study was the discovery of heavy yielding palms for further observation and breeding experiments with a view to the production of high yielding strains for general cultivation.

The palms in the block under observation were planted in 1920-21. The planting distance was 30 x 30 feet square; the land is flat except at one corner where it includes rising ground, and this corner carried seventy-five palms. The soil consists of a well-drained, medium to light porous loam except that the undulating portion is of typical laterite loam. The collection of data commenced in January 1929, and records were taken once each week, but as artificial pollination was carried on during the first six months of the experiments and as it was obvious that many of the palms were not yet mature, the figures in Table 1 relate only to data recorded during 1930 which was a good cropping year.

Artificial pollination of the palms ceased in July 1929, and by the end of that year over ninety per cent. of the total number of palms could be classed as mature.

The weights of bunches of fruit were taken and whenever over-ripe bunches were encountered, all fallen fruits were carefully collected and their weights added. The results are tabulated in the following frequency table, which shows a wide range of variation (0 to 680 lbs.) in fruit production from 589 palms during 1930 and reveals a coefficient of variability of 47 per cent. (approximately).

Thus, this crop, as judged by a study of ten year old palms, appears to be more variable than coconuts locally since the latter have a variability of 34 per cent.⁽⁵⁾ based on records of mature palms—possibly the oil palms are still rather young.

TABLE I.
Frequency Table.

Variation in yield of fruit bunches per palm for 589 palms in 1930				
Groups	Frequency	Deviation	(Deviation) ²	F x D "
0 lbs	3	260	67,600	202,800
15 "	9	245	60,025	540,225
50 "	10	210	44,100	441,000
85 "	26	175	30,625	796,250
120 "	52	140	19,600	1,019,200
155 "	49	105	11,025	540,225
190 "	70	70	4,900	343,000
225 "	72	35	1,225	88,200
260 "	56	0	0	0
295 "	59	35	1,225	72,275
330 "	52	70	4,900	254,800
365 "	41	105	11,025	452,025
400 "	34	140	19,600	666,400
435 "	23	175	30,625	704,375
470 "	8	210	44,100	352,800
505 "	10	245	60,025	600,250
540 "	5	280	78,400	392,000
575 "	5	315	99,225	496,125
610 "	3	350	122,500	367,500
645 "	1	385	148,225	148,225
680 "	1	420	176,400	176,400
No	= 589	Mean	= 260	Total = 8,654,075

Standard Deviation = 121

Coefficient of variability = 47 per cent.

With regard to the above table, of the three palms which failed to produce fruit, two produced only male flowers during the year, and the third was obviously suffering from disease and had been severely treated. The actual mean production per palm was 257 lbs., but 260 has been taken as the mean for grouping purposes in working out the variation.

Separate calculations of the variability of the 75 palms situated on the undulating land and of the 514 palms growing on the flat area revealed coefficients of variability of 40 per cent. and 46 per cent. respectively, but the average yield per palm on the sloping land was found to be only 202 lbs. as compared with 268 lbs. on the flat land, the difference being probably due to lack of sufficient moisture on the undulating land. Also, it is probable that 75 palms are not a sufficient number to give a true indication of variability on the undulating land.

An examination of the yield figures shown in Table 1 discloses the fact that approximately 25 per cent. of the total population (or 149 poor producing palms) produced only 11 per cent. (16,680 lbs.) of the total crop (151,415 lbs.). Similarly, of the palms which produced better crops than the average, 9.5 per cent. (56 palms) of the population produced 18 per cent. (27,545 lbs.) of the total crop, 15 per cent. of the palms produced 27 per cent. of the crop and 30 per cent. of the palms produced 48 per cent. of the total crop.

These figures are fairly comparable with those previously found by the senior writer for coconuts⁽⁴⁾ and⁽⁵⁾ and for rubber⁽⁶⁾ both growing under fair average estate conditions in this country, and indicate a wide scope for selection amongst the better yielding palms, since it appears from fruiting records on young palms extending over 5 years taken by the staff of the Agricultural Division of the Department of Agriculture at the Government Experimental Plantation, Serdang,⁽⁷⁾ that good yielding palms constantly produce good crops. The average production of bunches of fruit is approximately 260 lbs. per palm per annum. The table shows that 100 palms or 17 per cent. of the total number produced less than half that average crop. These palms would therefore probably be classed as uneconomic unless they could be stimulated by cultural or manurial methods to give better returns. On the other hand, 90 palms or 15 per cent. of the total population produced over 50 per cent. more crop (or over 400 lbs. of bunches per palm) than the average, and though the immediate environment of each palm undoubtedly plays a large part in its productive ability, it may safely be assumed that some at least of these 90 high yielding palms owe their heavy yielding characteristics to hereditary qualities, and it is from them that selective and breeding methods may be expected to produce the most remunerative results.

In Table 2, the average annual crops of the ten best palms at Serdang and of twenty of the best palms at Elmina, for 2½ years are given. From these thirty selections, it is hoped to plant progeny in due course in order to investigate further the problems affecting yielding capacity and to provide a supply of good seed palms; indeed, the Serdang selections have already been planted for those purposes.

As regards the Serdang palms, all of which were artificially pollinated, the yields are made up to date from the "Guide to the Government Experimental Plantation, Serdang F.M.S. January 1931" and the pericarp percentages (column 4) which vary from 56 to 67 per cent. are derived from figures given by the writers in a preliminary note on variation of individual fruits.⁽⁸⁾

The yields and pericarp percentages (varying from 55 to 76 per cent.) of the Elmina selections have been abstracted from unpublished records of the Economic Botanist, S.S. & F.M.S., in which the pericarp percentages are averaged from 75 fruits taken in three different pickings of twenty-five fruits each. The percentages can only be considered as approximations since they are calculated from differences between weights of fruits and weights of nuts and full precautions were not taken to avoid loss of moisture from the nuts before weighing them, although since little time was lost in the processes, the error is probably less than 3 per cent.

TABLE II.

	Palm No	Weight of fruit in lbs per palm per annum		Pericarp on fruit (per cent)	Average wt. of pericarp per palm per annum in lbs	Average per cent of kernel on fruit	Average weight of of kernel per palm per annum
		Bunches	Clean fruit				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
SERDANG	27	516	346	60	208	75	259
	37	420	284	58	161	69	196
	3	426	280	64	180	69	193
	7	424	276	62	171	80	221
	5	412	272	63	171	67	182
	9	414	260	60	156	80	208
	23	412	252	56	141	93	234
	57	356	236	64	151	67	158
	65	332	226	61	138	76	172
	67	334	198	67	133	61	121
	Averages	405	263	61	161	74	194
ELMINA.	214	648	389	64	249	49	191
	270	547	328	68	223	57	187
	207	526	316	64	202	61	193
	267	507	304	62	188	80	243
	242	503	302	61	184	86	260
	268	492	295	70	206	49	144
	360	483	290	62	180	55	159
	243	454	272	59	160	90	245
	180	450	270	59	159	52	146
	20	440	264	58	153	64	169
	208	437	262	55	144	106	278
	141	430	258	61	158	60	155
	179	429	257	62	159	65	167
	120	414	248	76	188	39	97
	27	411	247	63	156	60	148
	97	405	243	63	153	52	126
	36	402	241	62	149	49	118
	152	394	236	74	175	29	68
	58	386	232	62	144	54	125
	94	374	224	63	141	58	130
	Averages	457	274	63.4	173.5	6.7	167

The figures in columns 2 and 3 are the averages calculated from the yields obtained in the two and half year period ending July, 1931.

Palm oil is the chief commercial product of these palms, but for convenience, and since for general purposes it can be assumed that the oil content of the fruits is directly proportional to the amount of pericarp they contain provided that moisture contents are comparable, the average yielding ability of the selected palms has been expressed in pounds of pericarp in column 5.

The figures in this column show the calculated average annual yields of pericarp per palm, which for the Serdang selections (artificially pollinated) range from 133 lbs. to 208 lbs., while for the Elmina selections (natural pollination) the variation is even greater—141 lbs. to 249 lbs. per palm. In this connection, no doubt the lie of the land, its texture, and water-retaining capacities play an important rôle, but it must be borne in mind that the selections from Elmina have been made from a very much larger population of palms than those at Serdang and hence better selections should normally result.

Palm kernels form the secondary export product of this palm, so that the production of kernel per palm is shown in column 7 of the above table, and the percentages of kernel to clean fruit shown in column 6 are derived from figures given in (9) and from unpublished records to which reference has already been made. The figures in column 6, like those in column 4, cannot be regarded as accurate, but they are fairly comparable as they have been derived from triplicated tests on lots of 25 fruits collected at different dates in each case, and indicate the wide variation which occurs in this character (from 2.9 per cent to 10.6 per cent.) amongst these thirty selected palms.

Most of the selections at Serdang and all the selected palms at Elmina are situated on the flat land and obviously some of them occur in good patches of soil—(Serdang 3, 5, 7 and 9 with similar average yields are contiguous palms, as are 65 and 67 while at Elmina 267 and 268 and 179 and 180 occur together in pairs), still it may safely be assumed that in many cases, the variation in yield is due to inherent qualities. Unfortunately, the only method of defining the inherently high yielders from those which have given good records on account of particularly favourable soil conditions is by a study of their progeny yields and as propagation is only possible by seed, this is a slow but necessary process and will be initiated as early as possible from selfed and cross-pollinated seed. The facts of variation which have been cited show that the average annual yield of oil palms under good estate conditions is approximately 260 lbs. of fruit bunches per palm. This, according to Bunting, Eaton and Georgi, (*) is equivalent to about 155 lbs. of clean fruit, or roughly 90 lbs. of pericarp (45 lbs. of palm oil assuming 36 per cent. of moisture in the pericarp). With one exception (Serdang 67), all the selected palms show calculated yields of more than 50 per cent. in excess of the average, while 18 of the thirty selections show estimated yields 75 per cent. better than the average, and 10 palms even exceed the average by 100 per cent. or more.

Similar variation applies in the case of palm kernels, though these are of much less importance than the pericarp.

This wide range of variation of fruit production per palm (the percentage of pericarp on the fruit also shows some variation) should be of material interest to the planter as it indicates valuable commercial possibilities with this crop and provides ample scope for continued investigation of the yielding ability of selected palms.

Summary.

A comparison of crops from naturally and artificially pollinated young palms growing under avenue conditions is mentioned.

Variations in yield of naturally pollinated palms under ordinary estate conditions are defined and show a coefficient of variability of 47 per cent.

The yields of selected high yielding palms indicate ample scope for a continuation of field testing and of breeding investigations for commercial utility.

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METHODS OF TRAPPING CRABS IN PADI FIELDS IN KEDAH

BY

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Following up the success recorded* last year in the control of the fresh-water crab, *Paratelphusa seipunctata*, by means of pot-traps, further experiments were made this season at two places, namely Jitra and Langgar. At both places the crabs would have caused a serious loss of crop had it not been for the control measures undertaken as soon as attacks were observed. The result of the action thus taken was an early reduction in the number of crabs at the critical time, that is, when the padi seedlings were still in a tender stage of growth after planting and it was possible for the crabs to tear away the leaf sheaths and eat out the crown. Practically no damage was done and no re-planting was necessary as had been the case during the previous year.

At Langgar, pot-trapping alone was tried and most of the crabs were quickly captured. The pots were removed at the end of 26 days, that is, when no more crabs could be caught. Subsequent visits showed that there were no more attacks.

At Jitra, on the other hand, the number was such that it was found necessary to supplement pot-trapping with hand-collection and the use of fish-traps. The results were as follows:—

(1) Pot-traps	781 crabs
(2) Hand-collection	191 „
(3) Fish-traps "Bubu"	206 „

Ten pots were used in this plot of about $4\frac{1}{2}$ acres. The pots were sunk in the ground below water level and were baited with fried rice bran as described in the article (*loc : cit*).

Hand Collection.

About one week after transplanting it was considered unsafe to allow much water into the field from the irrigation canal as this would have led to an increase in the activity of the crabs which prefer a well-filled rice field. This method, however, cannot be recommended in areas which are dependent on rain-fall because an insufficient water supply might cause further damage to the crop. In the present instance it was possible to reduce the water supply as the area is irrigated and water could be admitted at will. In very shallow clear water, the crabs could be readily seen in the depressions in the field where the water was deeper. In a dry field, especially during the heat of the day, it was

* Sands, W. N. *Malayan Agricultural Journal*, Vol. XVIII, page 568.

still easier to catch the crabs when they were seeking cooler and better watered portions of the field. Hand collecting began on the day the plants were transplanted and continued for about a fortnight.

Trapping with "Bubu".

This fish-trap needs, perhaps, some description as it was the first time that it had been used for the purpose.

It is made with fine bamboo sticks laced with split rotan to a frame about $2\frac{1}{4}$ feet long. This frame is circular in shape at one end and is rather flattened at the other. The circular end has a diameter of one foot, while the flat end measures $1\frac{1}{4}$ feet in length and 5 inches in breadth. At the circular end of the trap is fixed the trap-door having a wide mouth which fits into the frame. It is made of the same material and is conical in shape. It is made in such a way that the sloping end which points inwards and is not closed in the centre allows a crab to enter, but once inside it cannot get out. The entrance leads into a small compartment and from this into a large one with another trap-door entrance of lighter construction. At the end of the trap is a small door which can be opened and closed and from which the captives are taken out and destroyed. This door is generally made of wood and is hinged with rotan.

This "Bubu" was placed at a point where excess water from the rice field was run out, as it was observed that the crabs migrated from field to field in search of food with the flow of the water, whenever suitable opportunity occurred. Trapping with "Bubu" was stopped at the end of 17 days, when no more crabs were caught.

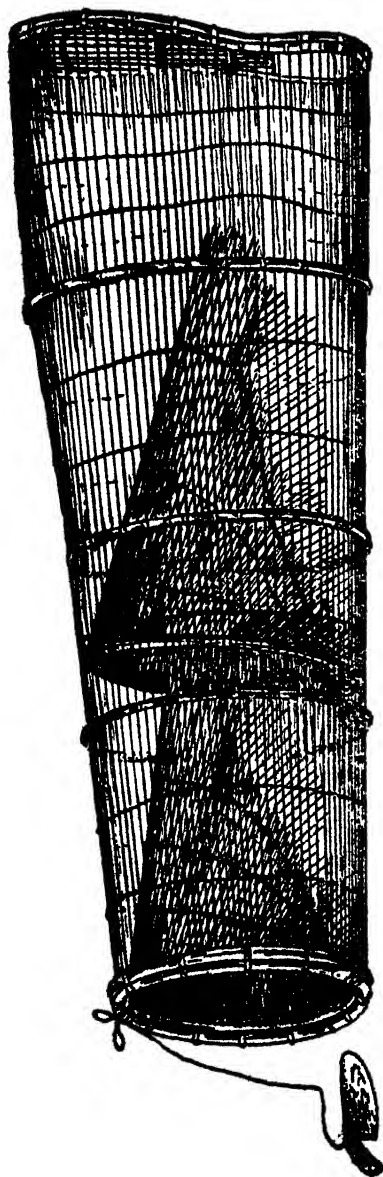
Young seedlings are considered to be out of danger when they are about 3 weeks old from the time of planting. After that the crabs seek other places in which to carry on their existence. Further, it was observed that the crabs always sought the low-lying portions of the field which were under deep water. It was also noticed that the crabs from an adjoining field, which had been dry owing to broken bunds, continually travelled to the plot where the experiments were carried out. A few were found moving in the day time and were caught by hand, but the greater number usually came in at night, judging from the results of the pot-trapping.

Trapping with Bamboo Joints.

Another very ingenious method has been devised by a local Malay, namely, trapping by means of large bamboo joints $1\frac{1}{4}$ feet long and with an inner diameter of $1\frac{1}{4}$ inches.

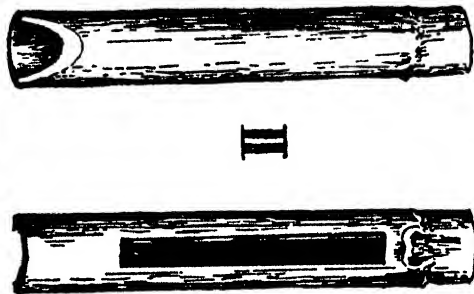
Description.—The bamboo joint is cut just below the node at each end so that one end is closed and the other open. About half the circumference of the open end is cut at an angle of 45 degrees to make it easier for the crabs to enter. A slit of $\frac{1}{3}$ of an inch wide and 10 inches long is also opened along one side of the cylinder starting just above the node.

I



I FISH TRAP KNOWN AS
"BUBU"

II



II TWO VIEWS OF THE
BAMBOO CRAB-TRAP.

Bait.—The bait used is fried rice tied into a small bundle with a piece of cloth and placed at the far end of the cylinder.

Mode of Employment.—The traps are laid flat on the ground below water and are examined every day by covering the open end with one hand so as to prevent the crabs escaping and then lifted up to allow the water to run through the slit.

About 150 of these cylinders were used over an area of 15 acres. The average catch was about 2 crabs per cylinder per day. The man in charge put the total number caught at about 9,000 in one month, after which period he stopped trapping as his padi had grown out of danger. The statement was supported by several people in the neighbourhood.

The outstanding feature in the use of this kind of trap is its cheapness and its simplicity. Furthermore, it can be made in any quantity on the spot at a very short notice and is unlikely to be stolen. The traps employed by the man in question were made by himself. The captured crabs are not touched by hand but just emptied out of the bamboo-joints by shaking them into a kerosine tin. The crabs caught are then killed with boiling water.

PISANG SA-RIBU

BY

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This curious banana, referred to in Java as *Musa chiliocarpa*, Backer, has been established at the Government Experimental Plantation, Serdang. The illustrations represent specimens cultivated at Serdang. A single sucker was obtained originally from a Malay holding at Batu Caves, Selangor. The banana was introduced under the name of Pisang Sa-ribu (Malay: Pisang, banana; Sa-ribu, one thousand) but subsequently a second name Belalai Gajah (Malay: Belalai Gajah, Elephant's trunk) was stated to be used in Selangor.

Pisang Sa-ribu differs from all other cultivated bananas in that the proportion of male and female flowers is the reverse of normal. In place of the small number of fruit-producing and large number of male flowers ordinarily occurring, the flowers almost all produce fruit. Consequently, with the exception of a small number of neuter flowers at the commencement of the inflorescence, the fruit stalk carried an extraordinary number of fruits forming a compact tapering bunch. The fruit-producing flowers have perfect stamens bearing pollen.

The original sucker produced an inflorescence during May, 1930 and the fruit bunch ripened in the following November. The bunch was about 5 feet long, with 125 hands, each hand bearing about 14 fruits. A total of over 2,000 fruits matured.

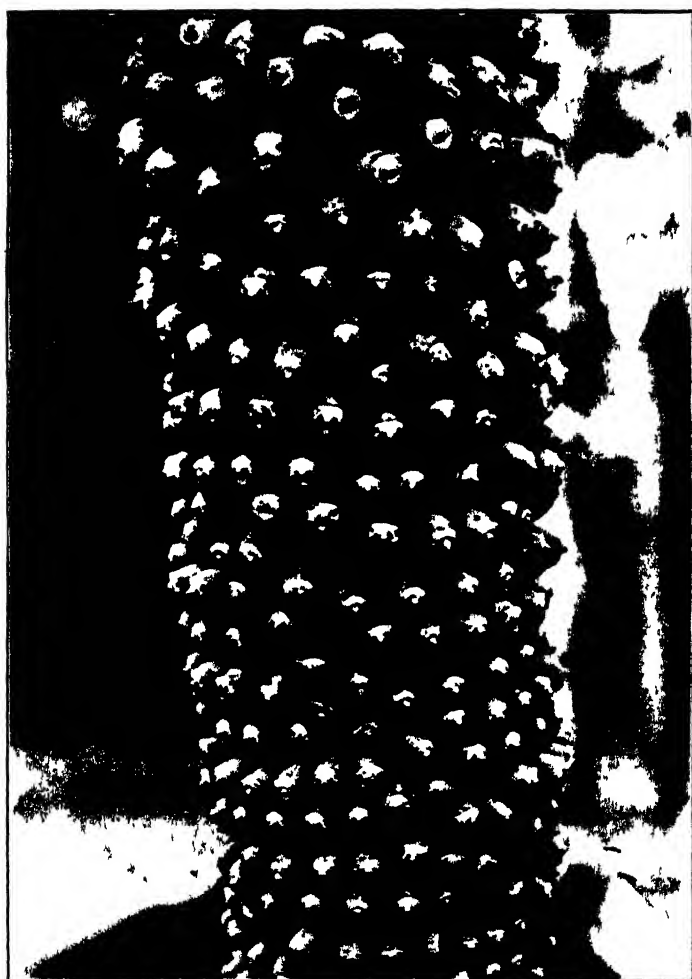
Several suckers were obtained from the old stool and planted about the middle of November, 1930. Flowering stalks appeared during April, 1931, the fruit bunches ripening six months later.

The following is a description of an average bunch when ripe. Length 6 feet, neuter hands 6, with 10 to 14 imperfect fruits on each hand. Perfect fruits numbering altogether 2,850 contained in 170 hands. A number of unopened female flowers remained on the "heart" when the bunch was cut. This is a smaller bunch than that recorded from Java, where a raceme 6 feet 5 inches long consisting of 151 hands, numbering altogether 3,137 fruits was described (*Teysmannia*, Vol. XIV, 1903, page 35). The mature fruit is 2 inches long and 1 inch in diameter. Skin yellow with chocolate spots and of thick texture. Flesh floury, creamy yellow, golden yellow in centre, good flavour but too small to be eaten.

Although Pisang Sa-ribu is of little or no value as a fruit it would appear to have possibilities in the hands of the plant breeder owing to its comparatively unlimited fruiting capacity. The fruits so far examined were quite seedless, but the pollen appears virile. Several Malayan bananas under cultivation at Serdang produce edible fruits containing seeds, namely; awak betul, awak legor, abu batu, and susu. Pisang awak legor is the most consistent seed producer. The individual fruits of this variety contain an average of 30 seeds, the majority of which germinate readily.



PISANG SA-RIBU
Fruiting bunch 6 feet long



PISANG SA-RIBU.
Mature fruits, reduced.

Abstracts

THE PRESENT STATUS OF STAPLE-CROP PRODUCTION IN THE PHILIPPINES *

This article indicates that the Philippines import annually foodstuffs to the value of some \$27,500,000.†

The chief items of import are rice, tobacco, vegetables, fruits and nuts, coffee, cocoa, peanut oil, spices, and castor oil.

The import of rice averages \$10,340,000 in value which is only approximately 4 per cent. of the value of local production. Locally produced rice commands a higher value than imported rice so that, by weight, roughly 93 per cent. of the total consumption is produced locally.

It is emphasised that the large annual foreign expenditure should be reduced by stimulation of home production and it is suggested that this is best attained by (a) protective tariff on rice, (b) prevention of manipulation by rice dealers, (c) better credit and transport facilities, and (d) improved cultural methods including use of fertilizers, selected seed, better irrigation, etc.

Maize imports average \$770,000 whereas formerly local production practically supplied the demand. The decline in production is said to be due to soil exhaustion through erosion coupled with the prevalence of pests and diseases, and the author maintains that improvement in production should follow terracing of the lands to prevent erosion, better transportation facilities from producing areas, and better pest control.

Tobacco, chiefly as cigarettes, is imported annually to the value of over \$4,400,000 despite excellent conditions for local production. The needs of this industry are intensive specialization, adequate capital, the production locally of wrapper tobacco, and propaganda to improve the market for local production.

Vegetables are imported annually to the tune of over \$3,850,000, the chief articles being cabbage, garlic, onions, potatoes, and even sweet potatoes. It is suggested that more intensive cultivation, rigorous pest control, and the better preparation for market of locally grown vegetables should go far to reduce this import.

In 1929, over \$3,630,000 worth of fruits, including peanuts, (\$275,000) were imported. Local production could supply most of these fruits if orchards were given adequate care regarding selection of planting material, soil management, and pest control, particularly periodic spraying.

* Manuel L. Roscas in the *Philippine Journal of Agriculture*, Vol I, No. 3. 1930

† In this Abstract, Straits currency is used throughout. \$1 = 2s. 4.

Coffee and cocoa imports average \$1,540,000 and \$1,375,000 respectively in value annually, and these bills could be completely counteracted by increasing the planted areas where conditions are suitable and by better cultivation.

Spices and castor oil (pepper in particular) were imported in 1929 to the value of \$216,700 although they could readily be grown locally. In this respect it is mentioned that \$10,000,000 of pepper is imported into North America annually, and it is contended that part of this vast market might be obtained by Philippine produce grown on a large scale. The author summarises his article by emphasising the need for more intensive cultural methods, better preparation of products for market, and Government assistance in the marketing of new products.

THE COCONUT OIL INDUSTRY. *

In 1907, nearly 3,000,000 acres of coconuts were under cultivation, and, at the present time there are approximately 7,000,000 acres devoted to the cultivation of the palm, of which area more than one half is in the British Empire. India possesses the largest area under cultivation, but this is no indication of the amount of oil or copra exported from that country, as owing to religious scruples forbidding the use of animal fat as a food, a large proportion of the natives rely entirely on the locally produced vegetable oils.

Copra Production.

The splitting of coconuts is generally done by hand; although in some districts machinery is in use for this purpose, it is found to be not much quicker than native labour.

A brief description of sun drying and smoke kiln practice is given. It is stated that one British firm has recently supplied several copra drying machines for use abroad and that these plants have a capacity of 150 tons of nuts (? 75,000 nuts) a day.

The Expression of Coconut Oil.

Before the oil may be expressed from the copra, it has to be ground first to a coarse meal, after which it is further reduced by special rolls. The meal must not, however, be ground too finely otherwise the coconut oil produced will be cloudy and in the subsequent purification the working loss of oil will be high. A full account of grinding and disintegrating is given.

*The Coconut Oil Industry, A. E. Williams, 94.7, "Engineering" October 16th 1931, page 481.

Two types of oil press are fully described, the hydraulic press and the screw press, the latter being of special interest to small producers as the capital charges are not high. In this machine the oil is expressed by means of a rotating screw which exerts a gradually increasing pressure on the meal which passes through continuously.

The best yield of oil is obtained when careful attention is given to the cooking of the meal before expression. In the case of damp meal, surplus moisture must be evaporated and the meal cooked by means of dry steam. Very dry meal may however be heated by live steam.

Cattle meal:—The residual meal from the presses may contain from 5 to 9 per cent. of oil and is valued as a cattle foodstuff. Other materials are frequently incorporated before the meal is marketed.

The Uses of Coconut Oil.

Soap:—In combination with other oils and fats, coconut oil is largely used in the manufacture of soap. The special points in its favour are that it normally does not require bleaching before use, it produces a hard soap which is fairly soluble and which will lather particularly well, and it gives a higher yield of the by-product,—glycerine, than any other oil. At the present time coconut oil represents 12 per cent. of the oils used in soap-making in Great Britain and in America about 20 per cent.

Margarine:—In the manufacture of margarine, the special points in its favour are its melting point, its texture and its consistency. Experience has proved vegetable oil to be quite as satisfactory as animal fats for edible purposes except for their deficiency in vitamins which, in the best margarine factories, is corrected.

Recently, coconut oil has largely displaced cotton-seed oil in the American margarine industry. Coconut oil is used in 35 per cent of the margarine made in Great Britain while in America the figure is 50 per cent.

Confectionery:—Coconut oil also enters into the manufacture of chocolates, toffee and biscuit manufactures.

Reviews.

The Preparing for Market and Marketing of Tea.

Eighteenth Report of the Imperial Economic Committee. H. M. Stationery

Office, London, 1931, 74 pp., price 8d., post free.

At a time when interest is directed to the potentialities of tea production in Malaya, both in the uplands and on the plains, this publication on tea is most opportune.

The Report gives a concise history of the growth of the tea growing industry and of the methods of marketing, tea-tasting and blending. But interesting as are these facts, they are moderately well known and are of much less value and significance in this place than are the sections which follow, which treat with questions of consumption, demand and supply, leading to a discussion on the restriction of out-put and to a most valuable seven pages on "Market Expansion". The last two sections discuss research and the conclusions of the Committee.

Doubtless those who embark on the development of land with tea will have satisfied themselves on the suitability of the land for this purpose, but the points on which they may still entertain doubts are on the questions of varieties of tea most profitable and on the future prospects of the tea industry. It is on these problems that this report throws considerable light and on account of which it is recommended to the reader.

At the time of the introduction of tea into Europe, the supplies came entirely from China, but in course of time, the development of the industry in India and Ceylon ousted China as a serious competitor in this market, although it is noted that China tea is still popular in the United States of America. At the present time, the British Empire produces about 70 per cent. of the world's supply and nearly 70 per cent. of it is consumed within the Empire. It is significant that the exports from China now amount to only 8 per cent. of the total world's supply.

"Although no figures are available, the production of tea in China is believed to be very large, but it is principally a peasant production, grown in the immediate vicinity of the peasant's homestead, and gathered and prepared by his family. Failure to keep pace with the large scale production and the more scientific and more hygienic methods of machine manufacture on the plantations of India and Ceylon facilitated a general change of taste among consumers, and particularly in the United Kingdom".

But while we may so easily dismiss China as a rival to Empire-produced teas, a more serious competitor is to be found in the Netherlands East Indies, where the production has increased considerably and the quality of tea produced, although not good, has considerably improved of late. The principal areas under tea (in thousands of acres) are India 773, Ceylon 450, Java and Sumatra—including native holdings—371.

The next subject of importance is blending, and for this the services of the tea-taster are essential. One of the aims of the distributor is to stabilise the price of the tea. This is necessarily somewhat difficult with such a commodity as tea which is subject to violent fluctuations in price. Some measure of stability is therefore attained by the use of "fillers", tea of low quality which in times of high prices can be mixed with better grades without very apparent deterioration in appearance or flavour. It follows that in times of low prices the demand for the lower quality tea declines and therefore its value, for the distributor will then use a greater proportion of better quality leaf. The stabilisation of price has, in part, been also met by the introduction of the coupon or "gift" system, although this is looked upon with some disfavour as it tends to distract the attention of the consumer from the quality and price of the article sold, to the attractiveness of the gift offered.

From the above, it will be seen that there is a surer and more stable market for the better quality teas. Tea drinkers are most discriminating and are generally prepared to pay for a good quality tea not only from the point of view of taste, but because they realise that such teas are more economical. It, therefore, behoves tea planters to aim at high quality tea and blenders to keep in touch with the trend of public taste.

It is a point worthy of note that the flavour of tea is very much controlled by the method of manufacture and is not, as is generally assumed, entirely a question of altitude.

It is definitely asserted that it is possible to obtain any blends of tea suitable for consumption in the United Kingdom entirely from Empire produced tea. This is, actually, an accomplished fact with certain large distributors, although insufficient advantage has so far been taken of the advertising value of Empire products by such distributors. The report favours the encouragement of blending by grocers and offers suggestions for encouraging voluntary declaration of origin of teas in the blend.

The stock position is studied in some detail. The general effect of the slump in tea in 1920 was the introduction of finer plucking, and this system was generally adhered to on estates in subsequent years of high prices. Native production, however, and supplies from the Netherlands East Indies have somewhat interfered with the good effects of this system and has, in fact, to some extent reduced the degree of success of the tea restriction scheme introduced in 1930. The report's final comment on tea restriction provides the key for the subsequent sections on prices and the future of the industry. On the subject of restriction, the report states—

"At the best, it is a palliative, not a cure, and the continued prosperity of the tea industry as a whole depends on increased consumption and the development of greater world markets".

A consideration of the statistics of the *per capita* tea consumption in 36 countries, comprising practically all Europe, America, Australia and part of Africa, amply bears out the above contention.

The United Kingdom is the principal tea consumer, the annual consumption per head being 9.20 lbs. It is thought that there is still room for expansion on this market although the annual increase must necessarily be at a slower rate than during the past 10 or 20 years. If this be true of the United Kingdom, what can be said of the United States of America, when the *per capita* consumption is only .75 lb. per head? An account is given of the attempts so far made to increase the consumption of tea in the U.S.A. and valuable suggestions are advanced for future efforts in this direction.

Among other countries of importance Russia is given particular notice on account of her deep-seated tea drinking habits and vast population. Before the Revolution, Russia was the second largest importer of tea in the world. She still ranks as the third largest importer.

"In 1927-28 the total imports of tea into Russia were 65 million lbs. in contrast with 172 millions in 1914—a drop to little over one-third of the old figure, though, even so, it showed an increase of 34 per cent. on the figures for 1926-27....."

"Under-consumption in Russia is one of the principal factors in the present situation. Were Russia able to purchase tea on the pre-war scale there would be no surplus and no talk of 'over-production'. The difference between the present and pre-war import into Russia is more than 100 million lbs.—or nearly twice the amount of reduction sought under the restriction scheme".

It is impossible to forecast the future development of the Russian market. The Russians themselves are attempting to develop their own supply. Under the Five Year Plan the estimated production of tea in Russia is 500,000 lbs. in 1929, rising to 46,000,000 lbs. in 1940. Even if these estimates are realised there remains a considerable gap between their production and the actual pre-war figure of imports. It is possible that this difference may be filled by imports of tea from the British Empire if suitable arrangements can be made regarding credit.

The report, however, looks less on foreign markets for the solution of the present difficulties of the tea industry than on the possibilities of increasing consumption in the Empire. "The market at India's own door may yet prove the answer to the problems of the industry". Considerable success has attended the work of the India Tea Cess Committee towards encouraging the consumption of tea in India.

Tea production is not only increasing in India, Ceylon and the Netherlands East Indies, but is developing in the Union of South Africa, Nyassaland, Kenya and Malaya. The report urges that every effort should be made to develop the consumption of tea in these countries of production, pointing out that those engaged in the local production of tea are best placed for encouraging local consumption.

The penultimate section of the report discusses the present position of research and advises on its future development. In the first place, it is urged

that there should not be too rigid a specialisation on pathological research to the neglect of crop production and general husbandry. Further, closer co-operation between planters and research workers should be attained. "It is the actual application of research to industry which presents the greatest difficulties, and these can be overcome by co-operation and organisation".

The report also urges that there should be closer contact between the tea research in India and Ceylon and points to the need of closer contact between research workers and the London market.

Among the recommendations of great value is that for closer attention to the improvement of planting material and the inauguration of Government nurseries for the supply of first-class planting material at reasonable rates.

To sum up, the Imperial Economic Committee does not appear to look upon the future of the tea industry as hopeless, but as demanding, firstly, the maintenance of high grade tea production in the Empire—pointing out that the world's finest teas are grown in the British Empire; and secondly, propaganda and other means of stimulating the consumption of tea primarily in the country of production, then within the British Empire and finally in other countries.

There is much information in this report of great value to the infant tea industry of Malaya. This publication should indeed be widely read throughout the world. It is not only an informative document on this subject, but one of great value from a publicity point of view, pointing out the pre-eminence of British Empire tea and encouraging its consumption by reason of its purity and the great care taken in its production and marketing.

D. H. G.

Transport of Mangosteens by Sea.

*Report on a Further Experimental Consignment of Mangosteens from
Burma, 1931. Empire Marketing Board Experimental Consignments Report
No. 10, 8 pp.*

This report deals with the third attempt to transport mangosteens by sea from Burma to the United Kingdom, the two previous attempts being in 1929 and 1930.

In the present instance, the fruit was packed in flat boxes, each containing 50 fruits. It was in cold storage on the voyage of 33 days at a temperature of about 60°F. The value of the experiment is somewhat vitiated by lack of data of the temperature on the voyage, a point which is fully realised by the writer of the report. It was intended that the temperature should be maintained at 50°—55°F.

The boxes of mangosteens were packed in two conditions of ripeness, *viz*: almost ripe and just ripening. Wastage was slightly greater in the more mature fruit, the average wastage of "untreated" fruit being 54 per cent. for the "almost ripe" and 49 per cent. for the "just ripening".

Mangosteens were also "treated" by dipping in rubber latex. It was found that there was no material difference between the wastage of fruit so treated and untreated fruit. The former, however, retained its fresh appearance.

The Report states that "little difference could be noted between fruit that had been once dipped in rubber latex and the 'twice-dipped' fruit, although the latter was perhaps preferable in that the thicker membrane could be more easily removed". Actually a difference in loss of weight during shipment is to be observed, which in itself, one would imagine, would influence the attractiveness of the fruit and also its flavour. The actual percentage loss of weights are as follows :—

Almost ripe Once dipped 11.4 per cent. Twice dipped 8.6. per cent.

Untreated 13.7 per cent.

Just ripening Once dipped 10.4 per cent. Twice dipped 9.5 per cent.

Untreated 13.9 per cent.

While dipping the fruit in latex was effective in preserving the fresh appearance, it appeared to have no effect on wastage. The Report continues :—

"Whether the treatment (i.e. dipping in latex) is to be recommended for commercial consignments is doubtful. The primary object of the present experiment was to ascertain if a fairly thick latex coating would reduce hardening of the skin. It now appears, however, that it is possible to ship untreated mangosteens without undue hardening or shrivelling provided the carrying temperature is suitable and the fruit sufficiently ripe, so that for this purpose the latex membrane is unnecessary".

Other possible objections to latex treatment are stated to be labour, expense, delay in packing, and prejudice in the trade and among consumers.

The wastage of the fruit was found to be due to a fungus—*Diplodia*,— which is thought to be largely preventable by the adoption of precautions in the orchard. It is, however, quite possible that *Diplodia* infection occurs not only in the orchard, but at any stage before chilling. Given freedom from *Diplodia* infection, it is the Reviewer's opinion that further experiments with latex covered fruit would be justified on account of its superior appearance on arrival. Once it is definitely proven that latex-covered fruit is superior in any respect to untreated fruit, there appears no reason why the technique of dipping and packing should not be improved with a consequent lowering of costs. It is unlikely that the prejudices of the trade or consumer will react against the dipping of fruit. The public look with favour on any process which shows them that the product is being packed with the greatest care possible, while the removal of the latex covering offers no objectionable features.

Imperial Agricultural Bureaux, Second Annual Report of the Executive Council 1930—1931.

H. M. Stationery Office, 12 ~~pt.~~ price 1s. 0d. net.

In the issue of this second annual report, the Executive Council gives evidence of the increasing usefulness to research workers of the eight Bureaux which were founded on contributions from the Governments of the Empire.

The close association between the Bureaux and research workers generally has been stressed as an aim of this scheme. This contact is being achieved not only by the distribution of printed information, but by correspondence and personal meetings between the Bureaux and the actual workers.

During the year under review, three special conferences were organised in connection with three of the Bureaux—Soil Science, Animal Health and Fruit Production which were well attended by research workers both in the United Kingdom and the Empire overseas. A restricted number of tours were made by officers of the Bureaux which enabled closer touch to be maintained with workers on particular problems.

The need of published abstracts has been realised by the Bureaux, for the mass of literature is now so great and so scattered that without the aid of a "central clearing house" such as is provided by the Bureaux it is difficult for the research worker to be cognisant with the advances made by other workers which have a bearing on his own work. Arrangements were, therefore, made whereby the preparation and issue of journals of abstracts or extended titles connected with each of the eight Bureaux would be undertaken. A list of journals issued is given, some of which have been noted in the pages of the *Malayan Agricultural Journal*.

One of the most interesting and important decisions of the Council is concerned with the issue of an abstracting journal on questions of Nutrition. The need of such publication has been long felt, while the importance of the subject is more keenly realised than ever before. As much of this nutrition work is common to workers whose chief interests may be concerned either with humans or with animals, co-operation has been attained between the Imperial Bureau of Animal Nutrition and the General Medical Research Council, with the result that we are promised an abstracting journal on Nutrition which will deal with both aspects of the subject.*

Towards the achievement of its object of the collection and dissemination of information on research work accomplished or in progress, the Bureaux have made notable advances during the year, with the result that the organisation work carried on during this period will undoubtedly be brought to fruition in 1931-32.

D. H. G.

* The first two numbers of *Nutrition Abstracts and Reviews* have now come to hand. They contain 1334 abstracts or reviews.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

Fourth Quarter, 1931

BY

G. H. CORBETT.

Insect Pests in Golf Greens.

Information was sought in June, 1931, as to the control of insects damaging the grass of golf greens. A caterpillar (unidentified) was found to be the cause of the trouble. A "tuba" spray was recommended, but possibly owing to the wet weather then prevailing, it was not effective in controlling the caterpillar. Subsequently, experiments were conducted in order to ascertain at what strength lead arsenate could be safely employed without causing injury to the grass. Several strengths of lead arsenate (powder) were used and spraying was repeated weekly for eight weeks when the experiments were concluded. It was found that lead arsenate at all strengths, the weakest being at the rate of $\frac{1}{2}$ lb. to 50 gallons of water, controlled the caterpillars, but that strengths stronger than 2 lbs. to 50 gallons of water were inclined to cause burning. As a result of these experiments, $1\frac{1}{2}$ lbs. to 50 gallons of water is considered the most satisfactory strength of lead arsenate to use for the control of this caterpillar on golf greens.

In addition to the immediate control for this caterpillar, series of experiments were conducted on top-dressing the greens with soil and lead arsenate and other series on growing Bermuda grass in poisoned soil.

In the top-dressing series, lead arsenate was applied in varying amounts up to 2,420 lbs. per acre. With this amount, the grass was conspicuously burnt, but at the rate of 600—900 lbs. per acre no burning ensued.

In the poisoned soil experiments, Bermuda grass was planted in plots of lead arsenate poisoned soil at rates varying between 302 lbs. to 2,420 lbs. per acre. In all these plots, the Bermuda grass became satisfactorily established. Although slight differences were noticeable during the first two months or so, its growth in all the experiments was satisfactory and compared very favourably with the growth of grass in unpoisoned soil. On the whole, the Bermuda grass growing in a plot poisoned with lead arsenate at the rate of 1,512 lbs. per acre had possibly the best appearance.

The details of these experiments will be published in due course, but the results show that lead arsenate at the rate of $1\frac{1}{2}$ lbs. to 50 gallons of water will control caterpillars damaging the grass of golf greens, that top-dressings poisoned with lead arsenate at the rate of 600—900 lbs. per acre cause no burning and will prevent immediate injury by caterpillars and that Bermuda grass will grow satisfactorily in soil poisoned with lead arsenate at the rate of 1,512 lbs. per acre.

It may be mentioned that damage to the roots by grubs, caterpillars and

"white ants" burrowing under the soil may be prevented in due time by top-dressings which will eventually become incorporated in the subsoil and that greens may be rendered insect proof for a considerable time if they be laid down with soil which has been poisoned with lead arsenate.

Rubber.

An unusual outbreak of grubs damaging the roots of mature rubber has recently come under observation. The grubs, which are typical chafer grubs, do not confine their attention to the rootlets but have been observed practically entirely de-barking the lateral and tap roots. The area over which these grubs are numerous is possibly not more than 80 acres and is enclosed entirely on three sides by jungle. The area is completely clean-weeded and no other alternative food-plant than the roots of rubber is available to the grubs. The records appear to show that the beetles (*Leucopholis* sp.) commence to emerge from pupae in the soil about the end of December and continue until April. The generations undoubtedly over-lap. At the present time, grubs, pupae and adults may be found in the soil and adults have been caught on the wing.

Several experiments are in progress for the control of this beetle. Three species of Scoliid wasps have been found to be active parasites on the grub.

Coffee.

In Entomological Notes for the Third Quarter, 1931, attention was drawn to the desirability of not introducing coffee berries for planting purposes unless certified free from coffee berry beetle borer. During the past quarter, the writer visited Cameron Highlands in order to ascertain if the coffee berry beetle borer (*Cryphalus hampei*) was present. After very careful examination of the coffee areas no indication of the presence of the coffee berry beetle borer at Cameron Highlands was traced. Before contemplating introducing coffee berries for planting purposes to the Highlands from the Lowlands, it would be advisable and very desirable to send all such seed for examination and if necessary for treatment before running the risk of introducing this most serious pest of coffee to the Highlands.

Coconuts

The caterpillars of *Telicota palmarum* Mre. are only very occasionally collected from the coconut palm. In October, however, they were recorded in considerable numbers on young palms on an estate in Perak. In addition, *Hidari irava* Mr. and *Amathusia phidippus* L. were also reported towards the end of December. Whilst *Hidari irava* is most generally confined to small areas, *Amathusia phidippus* is more scattered. *Amathusia* in this instance seems to be checked by a Chalcid parasite, as many as 27 having emerged from one chrysalis,

Departmental.

FROM THE DISTRICTS.

The Weather.

The December rainfall appears to have been above average in most parts of the Peninsula excepting along a strip of the Negri Sembilan—Selangor coast. In many instances, very heavy downpours were experienced in the first half of the month which occasioned flooding of the Perak and Pahang rivers. From the reports so far received it is believed that the floods in Perak did less damage to crops than was at first feared. The same would appear to apply to Pahang, although full reports are not yet available from Perak and practically no information has been received from East Pahang.

Remarks on Crops.

Rubber.—Price quotations for small-holders' rubber are slightly above those which prevailed during November, ranging, in dollars per picul, from 8—14.50 for smoked sheet and 7—14 for unsmoked sheet as compared with Penang quotations of 12.25—13.80 for smoked sheet and from 9—13 for unsmoked sheet.

The position with regard to Mouldy Rot is similar to that reported last month. The wet weather resulted in great activity of the fungus, but in most instances painting with fungicides is preventing excessive damage to the renewing bark except in the very worst cases. It is reported from Province Wellesley that a slight rise in price resulted in increased tapping activity. No further change is reported regarding the area of small holdings in tapping.

Padi.—At the time of writing, no detailed information can be given with regard to the damage done to this crop by the floods in Perak and Pahang. Certain areas in Kuala Kangsar District were submerged to a depth of six feet or more, but when the water had subsided it was found that the crop had sustained little damage. Similarly, only slight damage is reported from Raub and Bentong Districts in Pahang. The position in Pahang East is not yet known.

In Selangor and in some parts of West Pahang, where harvesting was in progress, loss of the crop has been caused by the inclement weather. From all other parts of the country prospects are reported to be good. Harvesting has commenced in some parts of Kedah and Province Wellesley, and in Malacca and Negri Sembilan.

Tobacco.—Cultivation of tobacco in Kedah is extending to the Kulim and Bunda Bahru Districts where 35 acres have been planted. During the month 120 piculs of locally grown leaf was sold in Bukit Mertajam and Penang, prices ranging from \$15 to \$35 according to quality. In the Dagong area in South Perak some damage has been done by floods. In Selangor, fresh areas have been planted up at Sungai Buloh by Chinese as the result of successful trials made by the Chinese headman of the locality.

Rat Control in Padi Fields.—From Krian a certain amount of scattered damage is reported and heavy damage has occurred along the northern boundary of Bagan Tiang mukim as a result of planting operations in the Province, which disturbed the rodents there and caused a migration over the border.

Agricultural Stations and Padi Test Plots.

KEDAH. *Telok Chengai Rice Station.* Most of the short-season varieties have commenced to flower. A certain amount of spotting of the leaves occurred on long-season varieties, but the plants improved after heavy rains towards the end of the month.

Padi Test Stations.—Good growth was made by the plants at Jitra, Langgar and Rantau Panjang, but at Sala Kanan Plot deep water has resulted in some uneven growth.

Agricultural Station, Gajah Mati. The cover-crops *Calapogonium* and *Centrosema* have germinated fairly well and supplying and weeding were commenced.

PROVINCE WELLESLEY. *Glugor Padi Test Station.* Weeding of the whole Station was completed during the month. Rat damage has occurred in the long-season varieties to such an extent that reliable results from the experiments will not be possible. The short-season varieties have not suffered in this manner.

Bukit Merah Test Station. The padi has a healthy and pleasing appearance excepting in one plot where damage was done by *Sogata furcifera*. Flowering has commenced. Rain gauges were installed on both of these test plots during the month.

PERAK. (a) *Agricultural Station, Selama.* The erection of the fence and store was completed. Budded kapok was planted around the boundary and four varieties of bananas, a plot of pepper and two varieties of pineapples were planted.

Kuala Kangsar. A small crop of oranges is nearly ready for gathering. Seedlings of a Rangoon type of tobacco have been pricked out prior to planting. The Chinese tobacco planted last month sustained damage as a result of heavy rain. The rambutan seedlings have been transferred to bamboo pots to facilitate handling. Groundnuts have been sown and yams are being harvested.

(b) *Padi Stations and Test Plots, Talang.* On the 20th the whole Station was flooded to a depth of 5 or 6 feet and remained in this condition for 2 days. Notwithstanding this experience, the plants appear to have sustained little damage except in small portions of the Seraup area where a certain amount of wash took place as the water subsided. The banana manual experimental area was planted up early in the month.

Lenggong. This Station was also flooded with very little apparent damage. Flowerings has commenced.

Bruas. Water difficulties were encountered as a result of a broken dam due to heavy rains. The plants still show uneven growth.

Bukit Gantang. A certain amount of rat damage has been sustained.

Flowering commenced on the local radin, S. 741 and N. 24 varieties.

Kamunting. Tri-weekly liberations of parasites have been continued, but stem-borers appear to be causing some damage. At the end of the month flowering had commenced over the whole Station.

Selinsing. Stem borer counts indicate an infestation of 11.73 per cent. A little rat damage has been done but, on the whole, plants are in good condition.

SELANGOR. Cheras Agricultural Station. The higher land reserved for permanent crops has been lined and holed ready for planting. The construction of the main access road was finished and 5 inspection paths completed. Fence erection was completed and the borders of the roads and paths were planted with carpet grass. Plans of the market gardeners' house and of the shed have been approved and work on their erection will be commenced without further delay.

Kajang Test Plots. The varieties Radin 2 and 13 were harvested during the month. Much damage was done by pests as all the surrounding padi has been harvested

Kuang Test Plot Harvesting is nearly completed. The operation suffered interference on several occasions from rain which resulted in some loss of grain.

NEGRI SEMBILAN. (a) Agricultural Station, Seremban. Yams were harvested and the citrus trees sprayed with kerosene and soap emulsion

Rembau. Fencing, gates, roads, well and propagating house were completed. The quarters and cooly lines were also completed and handed over by the Executive Engineer and occupied by the staff. Areas for clove, nutmeg and citrus have been lined ready for planting. Pepper plants were planted

Rembau Padi Test Plots Flowering has commenced on a few plots.

PAHANG (a) Agricultural Stations, Lipis The citrus area was supplied with marcots. Maize and tobacco were sown and tapioca and tobacco is being harvested.

Temerloh. Buildings, fences and gates are now completed. The Station was under about 11 feet of water during the floods.

(b) Padi Test Plot, Dong. This Plot escaped floods. Flowering has commenced. Some varieties are rather badly lodged.

Temerloh. Floods did much damage to the crop and some of the plots have been completely destroyed.

Pahang East. No information is as yet available regarding the Agricultural Stations and Padi Test Plots in Pahang East.

MALACCA Agricultural Station, Sungei Udang. Plantings were made of two varieties of pineapple, kapok and rambutan and chiku marcots. Further progress was made with the buildings.

Pulau Gadong Rice Station. All padi has flowered and harvesting of the earliest varieties has commenced. The Italian strains of padi flowered within three weeks of transplanting.

DEPARTMENTAL NOTES.

Tours of the Acting Director of Agriculture.

The Acting Director of Agriculture paid an advisory visit to two coconut estates in the Bagan Datoh district of Perak on 7th. and 8th. December, 1931. He then proceeded to Cameron Highlands where three days were spent in inspecting the Government Experimental Plantation at Tanah Rata and other work in progress.

Government Dairy and Poultry Farm, Fraser's Hill.

The attention of visitors to Fraser's Hill is drawn to the existence of the Government Dairy and Poultry Farm at Jeriau, which is run under the control of the Department of Agriculture, S.S. and F.M.S., with a view to providing the public with supplies of fresh milk, poultry and eggs.

Milk.—The dairy herd at Jeriau comprises 25 pure-bred Friesian cows imported from South Africa and several pure-bred Jersey cows imported from Australia. All the imported animals passed the tuberculin test to show that they were free from bovine tuberculosis at the time of export.

The dairy farm is run under European supervision and every attention is given to the cleanliness of the milk supply, while all milking utensils and bottles are regularly sterilised with steam. Further, the milk is periodically tested by the Institute for Medical Research and the tests show that it is above the standard required for Grade A milk.

The milk is bottled at the Government Dairy adjoining the Post Office and is ready for distribution in bottles at about 7 a.m. and 3 p.m. Each bottle is capped with a printed disc bearing the name of the farm so as to prevent contamination.

The price of the milk is 25 cents per pint in returnable bottles and there is no necessity to place a regular order as there are ample supplies to meet the irregular demand of visitors to the Hill.

Facilities have also been arranged for the sale of milk at the Dairy at 10 cents per glass, when consumed on the premises.

Poultry and Eggs.—The poultry farm is also run on modern lines and includes a flock of pure-bred Rhode Island Red, White Leghorn and Light Sussex fowls imported from South Africa.

Supplies of eggs are on sale at the Dairy at 5 cents each for grade A (large) and 4 cents each for grade B (small).

Sittings of eggs of the pure-bred fowls can be obtained when available at a cost of \$3 for 12 eggs, without replacements.

As the farm develops, regular supplies of specially fattened birds will be available for sale at the Dairy.

Vegetables.—A large area at Jeriau is devoted to the cultivation of vegetables under strict European supervision and supplies of fresh vegetables can be obtained daily at the Dairy.

Visitors leaving the Hill can obtain baskets of vegetables to take down with them by placing an order on the day before departure at the Government Dairy adjoining the Post Office.

Order.—All orders and enquiries should be addressed to the Manager, Dairy Farm, Fraser's Hill ('Phone—Fraser's Hill No. 29).

Vacation at School of Agriculture, Malaya.

The School term concluded on 21st. December, 1931. The next term commences on 16th January, 1932.

Staff Changes.

Mr. E. A. Curtler, Assistant Agriculturist, took charge of the Government Plantation, Cameron Highlands, on 13th November, 1931.

Mr. J. Fairweather, Agricultural Field Officer, has assumed the duties of Agricultural Field Officer, Johore North, and is stationed at Muar.

Under the reorganisation scheme of the Department, Mr. A. E. Coleman-Doscas is acting as Senior Agricultural Officer, Perak, and is stationed at Taiping. Mr. F. Birkinshaw, who holds this substantive appointment, is acting as Chief Agricultural Field Officer.

Statistical. MARKET PRICES.

December, 1931.

The continued weakness in Sterling has been reflected in enhanced prices for several articles. The Homeward Conference announce a further increase in freight rates with the sole exception of rubber. Pepper, tin,* rattans and Illipe-nuts have been subjected to drastic increases, varying from 18 per cent. to 30 per cent., and this action is the subject of a protest from Merchants to the Conference. Other rates have been increased by 10 per cent. (*Singapore Chamber of Commerce Market Report.*)

Markets generally have been quiet, with only a limited amount of business passing.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 9.92 cents per lb. in December, the average London price being 3d. per lb. The prices in November were 8.75 cents and 3d. respectively.

Palm Oil.—The price at the beginning of the month was £21 rising during the second week to £21.10.0. Thereafter the price reverted to £21. The market closes steady. The above prices are C.I.F. Liverpool on a basis of 18 per cent. free fatty acids.

Copra.—Supplies have been small so that quotations have firmed up slightly. The average Singapore price in December for Sundried was \$5.71 per picul, as compared with \$5.50 in November. Mixed copra averaged \$5.09 per picul as compared with \$4.83 in November.

Coconut Oil.—The average wholesale export price of coconut oil during December was \$9.50 per picul. Copra cake was quoted throughout the month at \$2.20 per picul.

Gambier.—The nominal prices for Block gambier improved from \$12 to \$15 per picul, the average for the month being \$13.20 per picul. Cube No. 1 improved from \$22 to \$24 per picul, the average Singapore price for December being \$23 per picul, as compared with \$21.62 for November.

Rice.—The average wholesale price of Siam No. 2 ordinary rice in November was \$4.21 per picul, as compared with \$4.70 in October. The retail market prices in November in cents per gantang of No. 2 Siam rice were Singapore 32, Penang 35, Malacca 27 as compared with 33, 34 and 28 respectively in October.

Arecanuts.—Palembang arecanuts averaged \$4.22 per picul and Bila Whole \$4.30 as compared with \$4.46 and \$4.61 respectively in November. Being the end of the season there were no stocks of Kelantan Splits. For other grades the average prices in December were as follows:—Sliced, \$9 to \$11.31; Split, \$4.61 to \$6.06; Red Whole, \$7 to \$7.50—all per picul, the price within each range depending upon quality.

Coffee.—The demand has been very small. Java Robusta averaged \$18.37 to \$21.50 per picul, the price within these limits depending upon quality.

Corresponding prices for November were \$16.25 to \$17.88. Palembang coffee averaged \$15.62 per picul in December, as compared with \$13.25 in November.

Pineapples.—Until the last week of the month this market has been very active with considerable business passing at quotations. Buyers now appear to have filled requirements for the time being. With Packers fairly heavily over sold however, the market, continues steady. Cubes 1½ lb. advanced by 25 cents to \$4 a case, the average price for the month being \$3.90. 1½ lb. Sliced flat advanced 18 cents to \$3.60 per case, the December average being \$3.51½ per case, while the nominal prices quoted for 1½ lb. Sliced tall improved by 30 cents per case to \$3.75, the average for the month being \$3.61 per case nominal.

Tapioca.—Prices have remained steady. Average prices for December were :—Flake, fair, \$3.33 per picul; Pearl, seed, \$4.50 per picul. Medium, \$4.75 per picul.

Sago.—The market has been quiet with little business passing. Prices sagged during the later part of the month. Average prices for December were :—Pearl, small fair, \$4.85 per picul; Flour, Sarawak fair, \$3.20 per picul.

Nutmegs.—There has been but small enquiry during December and prices were as follows :—110 per lb., \$28.50 per picul, 80 per lb., \$36.30 per picul.

Mace.—Has followed the trend of nutmegs. Average December prices in Singapore :—Siouw, \$65 per picul; Amboina \$52.40 per picul.

Pepper.—Prices have shewn some fluctuations and close easier. Singapore average prices for December were :—Singapore Black, \$23.80 per picul; Singapore White, \$32.20 per picul; Muntok, White, \$33.20 per picul.

Cloves.—Nominal prices only are recorded for the Singapore market. Zanzibar averaged \$49.60 per picul nominal; Amboina \$54 per picul nominal.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Cumberbatch & Co. Ltd., Kuala Lumpur; the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133½ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY. *

November, 1931

Malaya.—Total foreign imports of rice for November 1931 amounted to 50,109 tons, as compared with 54,216 tons for the same month last year, of which 54 per cent. were into Singapore, 25 per cent. into Penang, 4 per cent. into Malacca, 12 per cent. into the Federated Malay States and 5 per cent. into the Unfederated Malay States.

Of these imports, 52 per cent. were from Siam, 44 per cent. from Burma, 3 per cent. from French Indo-China and 1 per cent. from other countries.

Gross foreign imports of rice into Malaya for the 11 months, January to November, 1931, were 637,733 tons as compared with 716,884 tons in 1930, a fall of 11 per cent. Net imports were 480,970 tons as compared with 530,439 tons in 1930, a fall of 9.3 per cent.

Total foreign exports of rice in November 1931 were 15,815 tons as compared with 16,348 tons for November 1930.

The stocks of padi and rice held by principal dealers, millers and estates in the Straits Settlements, Federated Malay States, and Johore at the end of October amounted to the equivalent of 57,124 tons of rice, as compared with 52,589 tons the previous month.

The imports of rice from all sources during October 1931 were—F.M.S. 19,085 tons, Johore 6,547 tons, Trengganu 2,103 tons, Kelantan 845 tons, Kedah 2,862 tons.

Padi reports indicate that work for the new season 1931—2 is in hand in all areas.

As we go to Press (28.12.31) reports are to hand that owing to the very heavy continuous rains in Pahang, much standing padi has been destroyed. The extent of the damage cannot at present be ascertained.

India.—The Second Forecast of the rice crop in Burma for the season 1931—2 issued on November 14, 1931, gives the area likely to mature as 12,258,000 acres, being 2.8 per cent. less than the final figures of last year. The Forecast states that the crop generally was good in Lower Burma and much improved by the September and October rains in Upper Burma.

Burma exports of rice and rice products (including exports to India) from January 1 to November 28, 1931 were 3,290,765 tons, an increase of 0.6 per cent. over that of the corresponding period of 1930.

Japan.—The 1931 rice production in Japan (Proper) is reliably reported at 7,717,800 tons, a decrease of 17.7 per cent. as compared with 1930. Stocks of rice in Japan (Proper) on November 1, 1931 were—according to *The Trans-Pacific Journal* dated November 19th, 1931—1,281,940 tons, an increase of 59.8 per cent. as compared with 1930. It is also stated that owing to the poor rice

* The following is an abstract of the General Rice Summary for November 1931, compiled from various sources by the Registrar-General of Statistics, S.S.

crop this year, it is likely to be necessary to import 701,000 tons to meet the requirements of the country.

Formosa.—The area under rice and the crop produced for the second rice crop this year have been estimated at 887,888 acres and 586,740 tons, being increases of 3.6 per cent. and 7.6 per cent. respectively as compared with 1930.

Siam.—Deliveries of padi at the Bangkok mills for the eleven months ending October 31, 1931 were 887,204 tons, an increase of 7.8 per cent. as compared with 1929—30 and a decrease of 20 per cent. as compared with the average of the past five years.

Exports from Bangkok for the same period were 1,088,812 tons, an increase of 10.9 per cent. as compared with 1929—30 and a decrease of 12.7 per cent. as compared with the average of the previous five years.

At the end of October 1931 the area under padi in 310 districts was reported to be 6,348,266 acres, a decrease of 4.3 per cent. as compared with the previous year. It is also reported that the total exportable surplus on November 1, 1931, amounted to 303,200 tons of rice.

Netherlands East Indies.—The total rice land is estimated at 9,750,936 acres as compared with 9,600,504 acres last year.

At the end of October 1931, the area harvested amounted to 8,263,610 acres, damaged to 416,267 acres and standing to 1,071,079 acres.

Imports into Java and Madura, January to October 1931, were 243,751 tons, as compared with 228,144 tons in 1930, and into the Outer Provinces, January to September were 246,492 tons as compared with 283,259 tons in 1930.

French Indo-China.—Entries of padi at the port of Cholon for the eleven months ending November 30, 1931 were 1,030,746 metric tons, a decrease of 87,242 tons (7.8 per cent.) as compared with 1930.

Exports of rice from Saigon for the eleven months ending November 30, 1931 were 897,561 metric tons, a decrease of 117,393 tons (11.6 per cent.) as compared with the previous year.

It is reported that by a decree published in the Journal Officiel under date of November 10, 1931, and promulgated in Indo-China on November 12, 1931, a considerable reduction has been made in the amount of export duty payable on all forms of rice.

Ceylon.—Imports for 10 months ending October 31, 1931, were 366,984 tons, a decrease of 20,731 tons (5.3 per cent.) as compared with 1930, and a decrease of 15,680 tons (4.1 per cent.) as compared with the average of the past five years.

Europe.—To Europe, period January 1 to November 12, 1931, the shipments of rice from the East were 993,822 tons, an increase of 49.1 per cent. as compared with 1930.

To the Levant, period January 1 to October 9, 1931, the shipments were 36,210 tons, an increase over 1930 of 180.7 per cent.

To the West Indies, period January 1 to September 27, 1931, the shipments were 127,373 tons, a decrease of 29.5 per cent. as compared with the same period of 1930.

AREAS OF PRODUCTIVE RUBBER UNTAPPED IN F.M.S. AND S.S. NOVEMBER, 1931.

(Estates of 100 acres and over).

TERRITORY	TAPPABLE AREA OUT OF TAPPING		TOTAL AREA UNTAPPED*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres.	Acres.	Acres.
Perak ...	8,252	27,505	35,757
Selangor ...	11,334	39,356	50,690
Negri Sembilan ...	16,201	21,358	37,559
Pahang ...	7,190	4,191	11,381
TOTAL F.M.S. ...	42,977	92,410	135,387
Province Wellesley ...	3,166	7,739	10,905
Dindings ...	217	1,659	1,876
Malacca ...	4,760	17,328	22,088
Penang ...	747	115	862
Singapore ...	10,612	5,198	15,810
TOTAL S.S. ...	19,502	32,039	51,541
GRAND TOTAL ... (S.S. & F.M.S.)	62,479	124,449	186,928

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. & S.S. during November (not included in the above figures) were:—F.M.S. 42,465 acres, S.S. 11,402 acres, Total 53,867 acres.

PRODUCTIVE RUBBER UNTAPPED IN THE UNFEDERATED MALAY STATES, NOVEMBER, 1931.

STATE	Productive Area Untapped (Acres)		Total area untapped (Acres) (c)
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Johore ...	21,723	46,779	68,502
Kedah (a) ...	14,298	15,445	29,743
Kelantan ...	6,700	999	7,699
Trengganu (b) ...	nil	nil	nil
Perlis ...	308	156	464
Total U.M.S. ...	43,029	63,379	106,408

(a) Registered companies only and are rendered quarterly, commencing with June, 1931.

(b) Registered companies only.

(c) Areas rested due to rotational tapping system are not included in this table. The acreage untapped owing to rotational tapping system were Johore 32,773 acres, Kedah 42,769 acres, Kelantan 1,200 acres, Trengganu 1,394 acres: Total 78,136 acres.

MALAYAN AGRICULTURAL EXPORTS. OCTOBER, 1931.

PRODUCT	NET EXPORTS IN TONS				
	1930	Jan. 1— Sept. 30th 1930	Jan. 1— Sept. 30th 1931	October 1930	October 1931
Coconuts, fresh ...	10,475	7,854	6,166	1,200	927
Copra ...	102,014	66,507	70,828	15,311	8,752
Coconut Oil ...	9,475	7,267	7,412	738	717
Palm Oil ...	3,211	2,165	2,754	433	711
Palm kernels ...	485	320	411	85	143
Pineapples, canned	57,689	46,965	47,116	1,766	2,011
Tapioca ...	31,195	23,512	21,941	2,929	2,033
Arecanuts ...	23,254	18,548	14,767	1,541	1,319
Tuba root ...	55½	—	49½	6	3½

CORRIGENDUM

Oil Palm Acreage, Malaya, 1930.

With reference to the Annual Report of the Director of Agriculture, S.S. and F.M.S., for the year 1930 published in the supplement to the Gazette of July 17, 1931, substitute the following figures appearing under the heading "Oil Palm" on page 9 of the Report.

		Mature	Immature	Total
Federated Malay States—				
Perak	...	2,144	15,021	17,165
Selangor	...	10,446	2,515	12,961
Negri Sembilan	...	504	270	774
Pahang	...	—	788	788
Total F.M.S.	...	13,094	18,594	31,688
Straits Settlements	...	N I L		
Unfederated Malay States—				
Johore	...	5,064	12,703	17,767
Grand Total	...	18,158	31,297	49,455

MALAYA RUBBER STATISTICS TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX.
FOR THE MONTH OF NOVEMBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of less than 100 acres and over				Production by Estates of 100 acres and over				Imports				Exports including re-exports				Stocks at end of month							
	Ports	Dealers	Estates of 100 acres and over	4	during the month	5	during the year 1931	6	7	during the year 1931	8	during the year 1931	9	during the month		during the year 1931		Foreign	Local	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over		
														Foreign	From Straits	Foreign	From Straits										Foreign	Local
MALAY STATES:—																												
FEDERATED MALAY STATES																												
Malacca	...	2,688	1,364	1,459	14,159	(2)	(2)	Nil	Nil	Nil	Nil	14,573	4,289	15,580	78,093	...	14,251	12,952	...	...	...	...	...	...	...	...	...
Province Wellesley	...	109	578	525	5,150	(2)	(2)	Nil	Nil	Nil	10	Nil	32	908	6,286	9,046	72,613	...	2,392	3,354	...	...	...	...	...	...	...
Dindings	...	105	134	95	1,057	2,414	22,863	677	13,977	6,548	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Penang	...	2,109	4,279	9	11	86	...	7,089	...	86,407	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Singapore	...	9,516	32,316	279	183	1,944	...	7,089	...	86,407	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total Straits Settlements	...	11,625	39,497	2,361	2,272	22,396	2,414	22,898	7,766	13,977	92,855	187,379	31,786	...	...	...	...	...	...	...	...	...	...	...	...	...	...
SEMITES																												
Malacca	...	2,688	1,364	1,459	14,159	(2)	(2)	Nil	Nil	Nil	Nil	14,573	4,289	15,580	78,093	...	14,251	12,952	...	...	...	...	...	...	...	...	...
Province Wellesley	...	109	578	525	5,150	(2)	(2)	Nil	Nil	Nil	10	Nil	32	908	6,286	9,046	72,613	...	2,392	3,354	...	...	...	...	...	...	...
Dindings	...	105	134	95	1,057	2,414	22,863	677	13,977	6,548	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Penang	...	2,109	4,279	9	11	86	...	7,089	...	86,407	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Singapore	...	9,516	32,316	279	183	1,944	...	7,089	...	86,407	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total Straits Settlements	...	11,625	39,497	2,361	2,272	22,396	2,414	22,898	7,766	13,977	92,855	187,379	31,786	...	...	...	...	...	...	...	...	...	...	...	...	...	...
TOTAL MALAYA																												
	...	11,625	54,586	20,295	21,105	218,186	17,507	176,834	7,787	13,987	93,062	187,411	48,012	13,936	483,859	186,914	4,445	58,765	21,800

TABLE IV
THE PROPORTION OF FOREIGN
IMPORTS AND EXPORTS IN
DOMESTIC PRODUCTION

AREA	For during the year 1931
Malay States	...
Straits Settlements	...
MALAYA	36,027 88,664

TABLE III
FOREIGN EXPORTS

PORTS	For during the year 1931
Singapore	31,820 314,853
Penang	11,925 111,236
Port Swettenham	4,096 53,610
Malacca	171 4,150
MALAYA	48,012 483,849

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley	Province Wellesley	Total
20	21	22	23	24	25	26
DRY RUBBER	11,652	30,128	4,479	3,295	929	50,478
WET RUBBER	2,599	2,604	694	177	1,463	7,537
TOTAL	14,251	32,737	5,173	3,472	2,392	58,015

- Notes**—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. *i.e.* Columns [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] - [3] - [4] - [5] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers.
4. The above figures are for the month of November, 1931, and do not include imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.
5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st December, 1931.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1931.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE					
	Means of		Absolute Extremes		At 1 foot	At 4 feet	Total	Most in a day	Number of days				Total	Daily Mean	Per cent				
	A.	B.	Highest	Lowest					Highest	Lowest	Precipitation .01 in or more	Precipitation .05 in or more				Thunderstorm	Fog morning obs	Gale force 8 or more	
	Max.	Min.	°F	°F	°F	°F	in.	mm.	in.	in.	mm.	in.	hr.	hr.	%				
Railway Hill, Kuala Lumpur, Selangor	88.9	72.0	80.4	95	70	80	74	82.9	83.8	10.89	276.6	2.78	21	19	9	3	144.80	4.83	40
Bukit Jeran, Selangor	87.3	72.5	79.9	90	70	80	75	83.6	85.3	11.21	284.7	2.31	18	18	3	3	179.90	6.00	50
Sitiawan, Perak	88.6	72.9	80.7	91	70	82	75	83.8	84.5	11.97	304.1	2.82	21	19	6	2	193.40	6.45	
Kroh, Perak	86.0	69.4	77.7	90	66	77	72	80.5	81.6	8.47	213.1	1.16	20	18	1	1	186.85	6.23	
Temerloh, Pahang	85.9	71.9	78.9	91	70	75	74	82.8	85.1	12.49	317.3	1.81	20	16	1	12	143.50	4.78	40
Kuala Lipis, Pahang	86.2	71.2	78.7	91	68	74	73	82.6	83.6	9.03	229.4	1.84	17	15	5	12	154.75	5.16	43
Kuala Pahang, Pahang	83.6	73.7	78.7	87	72	76	79	81.2	82.9	34.86	855.5	10.16	22	21		1	177.35	5.91	50
Mount Faber, Singapore	87.4	73.6	80.5	92	71	81	75	80.2	82.4	10.48	266.2	2.14	18	15	4		148.30	4.94	41
Butterworth, Province Wellesley	87.1	73.4	80.3	89	71	81	75	83.7	84.6	6.82	173.2	1.21	16	16			229.20	7.64	
Bukit China, Malacca	85.1	73.2	79.1	90	71	80	75	81.4	83.2	8.56	217.4	1.28	20	18	4		174.10	5.80	48
Kluang, Johore	87.0	71.6	79.3	91	69	79	73	81.2	82.4	10.73	272.5	2.79	19	16	4	6	138.55	4.62	39
Bukit Lalang, Mersing, Johore	83.7	71.8	77.7	87	69	77	74	80.5	81.1	19.41	493.0	4.82	21	20			152.95	5.10	43
Alor Star, Kedah	88.4	72.6	80.5	91	71	83	75	84.5	85.3	9.24	234.7	3.38	15	10	2		214.10	7.14	60
Kota Bharu, Kelantan	84.7	72.4	78.5	88	70	78	76	81.9	83.8	29.99	761.7	9.85	17	16	1		201.20	6.71	57
Kuala Trengganu, Trengganu	84.6	72.3	78.5	88	70	79	74	80.3	81.0	30.68	779.3	6.60	17	17	1		179.25	5.97	50
HILL STATIONS.																			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	70.6	58.4	64.5	75	52	65	60			11.84	300.7	1.83	28	21	2	5	144.75	4.83	40
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	70.4	57.1	63.7	74	50	66	62	68.8	69.4	11.89	302.0	2.11	27	22	2	7	134.45	4.48	38
Fraser's Hill, Pahang 4268 ft.	70.9	61.5	66.2	77	59	65	63	70.7	71.1	15.22	386.6	3.11	24	23	2	24	113.00	3.77	31

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

FEBRUARY, 1932.

EDITORIAL

Quality of Malayan Palm Kernels.

The growing importance of palm kernels from Malaya is a natural consequence of the development of the oil palm industry. The quantities of kernels exported are likely to increase considerably in the next few years as larger areas of the palms reach the bearing stage and the quantity of nuts produced justifies estates in installing machinery for the extraction of the kernel.

It is unlikely that extraction of oil from palm kernels will be undertaken in Malaya. Even the enormous African crop of kernels is shipped as such, to be crushed in the mills in Europe. It is important, therefore, that Malayan producers be informed of the quality of kernels desired by the crushers so that they may install suitable machinery for its production and perfect their technique accordingly.

The fact has early become evident that Malayan palm kernels command a slightly lower price on the European market as compared with the product from West Africa.

Doubtless the reduced price offered for Malayan palm kernels is partly accounted for by the relatively small quantities available. The price offered depends also on size and cleanliness of the consignment, colour of testa, colour of flesh and colour and acidity of the oil.

The subject is discussed in some detail by Major C. D. V. Georgi, O.B.E., in an article in this number under the title of "Malayan Palm Kernels".

The author shows from his investigations that the Malayan product is slightly superior to the West African kernels as regards oil content, but that the testa of the kernel is darker. This dark colour of the oil can be correlated with the pressure at which the fruit is sterilised and the artificial drying employed. It is shewn that the colour can be improved if the fruit is sterilised at a low temperature. It is admitted, however, that with the present system of treatment of the fruit, this desideratum is not always possible.

Seasonal Variation in Coconut Crops.

In an article in this number Dr. Jack discusses the question of seasonal variation in coconut crops, both by an examination of the annual net exports of copra and by the records of certain typical coconut estates. The results of this comparison of exports

and estate production agree very closely, the variation in the former being 6.9 per cent. and in the latter 6.2 per cent.

The number and size of nut varies from year to year, the variation of ripe nuts per palm is shewn to be 13.5 per cent. and of ripe nuts per acre from large estates 11 per cent.

The significance of these results is that the crops may be considered fairly steady as might be expected, since on account of its long maturation period, the fruit is not so dependent on weather conditions at any one time as are fruits with a shorter maturation period.

Malayan Pineapples.

The development of the Hawaiian pineapple canning industry, as will be seen by the short abstract appearing on another page in this number, has been of no accidental growth, but the result of a definite policy. The organisation which has been built up, and which has resulted in Hawaii becoming the most important producer of canned pineapples, has neglected no aspect of production and marketing which might result in economy of production or efficiency in marketing.

Reference to the report on the Malayan pineapple canning industry, published in the *Malayan Agricultural Journal* of September, 1931 indicates that the Malayan industry was brought into existence in very dissimilar circumstances and has developed along entirely different lines from those of Hawaii. Furthermore, Hawaii and Malaya are not in serious competition, as each caters for its own market.

We have to remember, however, that the Malayan industry has reached a turning point, so that present policy in cultivation and marketing will decide whether we shall retain and develop our present markets, or whether we shall surrender them in the face of the competition of the increasing choice of canned fruits from different parts of the world which are to-day offered to the public.

The recommendations of the Pineapple Conference are still under consideration, so that further comment at the present juncture is inopportune. Attention, however, is directed to the establishment of the Pineapple Experiment Station at Singapore. The Station is chiefly concerned with variety tests, cultivation, including experiments with mulch and manures, and possible systems of rotation in order to obtain data upon which the Malayan pineapple canning industry may be re-organised so as to rely less upon the produce obtained as a catch crop but rather upon a more permanent system of production.

Encouraging Padi Planting.

Attention is directed to an article describing a padi planting competition in Johore, which is contributed by an officer of the Malayan Civil Service—Mr. G. Hawkins.

The article is of interest in showing one method by which the research work of the Department of Agriculture filters through to the small-holder. In a covering letter the author states that this experiment is an instance where the

administrative Land Office can execute the ideas of the advisory Department of Agriculture. He stresses the point that the Department of Agriculture "is not and never can be organised to do the actual donkey-work of planting. It is the business of the Land Office, which has the necessary staff and which should be held to strict account for neglect". He concludes—"My article is therefore merely a suggestion to other Land Officers of one method by which interest can be raised".

We would add that both the research and field officers of the Department are prepared at any time to assist Land Officers in the devising of schemes which have for their object wider interest in padi planting and the adoption of more effective and modern methods of cultivation.

Departmental Reorganisation.

During the year 1929 was commenced a series of changes in the internal organisation of the Department of Agriculture which aimed at increased co-ordination of the work of its various branches and extension of its activities.

The first step was a change in the title of the officer in charge of the Department from that of Secretary for Agriculture to that of Director of Agriculture. This change was made to mark the substitution of an officer with a professional training for an officer of the administrative service.

Towards the end of the year 1930 the Director submitted to Government, in accordance with instructions, comprehensive proposals for the reorganisation of the Department. That portion of them relating to the Senior staff has recently been approved by the Secretary of State for the Colonies.

Under the older organisation the Department was divided into nine Divisions with an officer at the head of each who was personally responsible to the Director. These Divisions were Agriculture, Botany, Chemistry, Entomology, Mycology, Plant Physiology and Soils, Agricultural Economy and Publications, Agricultural Instruction of Malay Officers, Field Division. This organisation was somewhat cumbersome and did not readily ensure co-ordination of work and mutual exchange of information without excessive attention to detail on the part of the Director. Under the new organisation the Department is divided into four Branches, namely, Research, Field, Agricultural Economics and Publicity, and Agricultural Education. The Head of each Branch is personally responsible to the Director for the work of the Branch and can thus relieve him of a considerable portion of the details and at the same time help to secure close co-operation of all Branches.

Under this scheme the Research Branch is divided into six Divisions which are identical with the first six Divisions mentioned above. At the head of each Division is an officer responsible to the Director through the Chief Research Officer. The duties of the latter are to supervise the detailed work of each Division and to ensure that the work of different Divisions on various aspects of problems common to two or more of them is properly co-ordinated.

The Field Division is organised on the basis of the various States and

Settlements. The Senior Field Officer in each is responsible to the British Resident or the Resident Councillor, as well as to the Director through the Chief Field Officer. The duties of the Chief Field Officer are to ensure uniformity and continuity of agricultural policy in the various States and Settlements on the lines laid down for him by the Director, to keep the Field Officers fully informed of the results of the work of the Research Branch and in touch with the other two Branches, and to ensure a full exchange of information among the various Field Officers themselves.

The Branch of Agricultural Economics and Publicity is in charge of the Agricultural Economist and deals with problems in agricultural economics, the collection of statistics, the editing and managing of Departmental publications and the maintenance of the Library.

The Branch of Agricultural Education is in charge of the Vice-Principal of the School of Agriculture at Serdang who is responsible for the training of the students at the School and for such vacation courses in agriculture as may be required for such officers as Assistant Headmen or Malay members of the Co-operative Department.

Earlier in the year 1931 revised salary schemes for Asiatic officers of this Department were also approved, and existing officers have, so far as is at present possible, been transferred to these new schemes.

While the various sections of the reorganisation proposals were under consideration, a change of bias was imparted to the activities of the Field Division as a result of which greater emphasis was given to the work of agricultural instruction which had previously occupied second place to that of agricultural inspection for the purpose of ensuring control of pests and diseases.

While the attention given to inspection work has not been diminished, the work of agricultural instruction has already been considerably extended. Additional appointments for both European and Asiatic officers of the Field Division have been provided and additional small Agricultural Stations and Padi Test Plots have been established in various parts of the country, while others will be opened up as financial considerations will permit.

In addition, a gradual extension of field experimentation supervised by officers of the Field Division is being effected. This is necessary as results obtained at Central Experimental Stations such as Serdang Experimental Plantation and Titi Serong must be tested under varying local conditions.

The above is a brief outline of the main points in the reorganisation arrangements in the Department. Owing to the exigencies of space a number of details have of necessity been omitted.

Original Articles.

MALAYAN PALM KERNELS

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

An investigation has been carried out recently regarding the present quality of Malayan palm kernels to ascertain as far as possible the reasons for the slightly lower price offered on the home markets for such kernels compared with the West African product.

Although it is probable that the reduced price is due partly to the relatively small amounts of local kernels now offering, since there is no free market for them compared with West African kernels, which are shipped in bulk, it was considered advisable to obtain information on the points to which attention is given when assessing the value of kernels. Estates can then modify their practice, as far as it is economically possible, for their product to conform as regards quality with the requirements of the home markets.

In this connection it may be mentioned that the exports from Malaya, which were approximately 500 tons for 1930, are insignificant compared with the 500,000 tons, annually exported from West Africa. As might be expected, therefore, Malayan palm kernels are practically unknown on the home markets, large buyers not being interested in the relatively small consignments which local estates have to offer. Representatives of one or two prominent firms belonging to the Liverpool United General Produce Association informed the writer last year that no consignments of Malayan palm kernels had come to their notice.

There is no doubt that in the early stages of production, estates tend to concentrate on palm oil rather than on kernels, which are regarded more in the nature of a by-product. This is due to the fact that the proportion of palm oil, which also has a much higher unit value, is much greater than that of kernels, the approximate figures being 30 per cent. of palm oil and 6 per cent. of kernels. Further, since the price of high grade oil is approximately double that of kernels it can be calculated that, allowing recoveries of 25 per cent. of oil and 6 per cent. of kernels, the relative values of the products for a given weight of fruit are in the proportion of 8 to 1.

It must be remembered also, that kernel production involves the following additional processes subsequent to the removal of the oil:—the separation of the nuts and fibrous residue in a screen, the drying and cracking of the nuts, the separation of kernels and broken shell, and the drying of the kernels. Small estates, especially in the early stages, are apt to regard kernel production as relatively expensive and it is probable, therefore, that, in an endeavour to reduce

expenditure in this respect, the quality may suffer owing to lack of attention during one or more of the processes.

There is also the additional risk of kernels deteriorating through storage on account of the fact that a small estate must allow its stock to accumulate for several weeks owing to shippers being unwilling to deal with consignments of less than 15 or 20 tons at a time.

Factors affecting Price of Kernels.

Apart from the size and cleanliness of the consignment and the oil content of the kernels, three factors must be considered when judging the value of kernels, namely, colour of testa, colour of flesh, and colour and acidity of oil.

As regards cleanliness, it is understood that oil mills do not object to a small proportion of shell, the presence of the latter assisting in the crushing of the kernels by preventing the rolls from becoming too oily.

From the point of view of oil content the presence of shell is a disadvantage, since the oil content of a consignment of kernels is based on the sample as received, no allowance usually being made for shell, dirt, or moisture. The price offered is based on an oil content of 49 per cent., a premium of $1\frac{1}{2}$ per cent. being paid for each per cent. of oil in excess of that figure, while a deduction at a similar rate is made if the oil content is below the standard.

In this connection it may be mentioned that, although palm kernels, similarly to other oil seeds, vary in oil content, results obtained in this laboratory show that the oil content of local kernels is slightly above the average, provided the kernels are clean and have been well dried before packing.

The colour of the testa and of the flesh are important owing to the extent to which the colour of the residual cake or meal after removal of oil by expression or solvent extraction is influenced by a discoloration of the original kernel.

As is well-known, palm kernel cake is extensively used as an ingredient of feeding stuffs and buyers naturally prefer a light to a dark cake. Further, since with palm kernels there is a high proportion of residue for disposal, amounting to approximately 50 per cent. of the original weight of kernels, oil mills, which depend for their profits on the sale of cake, will also prefer the lighter kernel.

The colour of the oil is also influenced by the colour of testa and flesh and, while a dark oil is not of such great consequence as a dark cake, since for most purposes the oil must be bleached, there is little doubt that light coloured kernels are preferred.

The acidity of the kernel oil depends on two factors, proportion of broken kernels and moisture content of kernels on packing.

As regards broken kernels, there is a tendency for an increase in acidity of the oil as a result of the exposure of the flesh of the kernel to the air and the consequent risk of development of mould growth. Also, if kernels are packed moist, containing for example 10—12 per cent. of moisture, there is the additional risk of increase of acidity owing to over-heating and the possible development of a slight fermentation.

Collection and Analysis of Samples.

For the purpose of this investigation average samples of local kernels were collected from 13 estates, while the samples of West African kernels for comparative tests were obtained through the courtesy of the Malayan Information Agency.

With regard to the analysis, the tests were confined to determinations of the above mentioned factors affecting the price, the local kernels being examined both when freshly collected and after a period varying from 3 to 4 months in order to obtain an indication of any changes taking place as a result of storage. The period of storage was chosen to coincide approximately with the average time elapsing between preparation on the estate and sale on the home market.

A given weight of kernels, approximately 2,000 grammes (4½ lbs.), was selected at random from the estate sample and placed in a small sack, the latter being hung in a rat-proof wire cage during the period of the storage.

From the balance of the estate sample 100 kernels were selected at random and each kernel cut in half in order to judge the colour of the flesh. The remainder of the kernels was crushed between rolls, the material being pressed in a small laboratory hand-press to obtain a sample of oil for the determination of acidity.

After the period of storage, the kernels were weighed and a sample drawn for the determination of moisture, a similar procedure to that employed with the fresh kernels was adopted as regards judging the colour of testa and flesh, also the acidity of the oil.

The moisture content of the stored kernels was between 8 and 9 per cent. In this connection, therefore, it may be mentioned that, provided kernels have been well dried before packing, the loss in weight in transit to Europe should not exceed 4 per cent., the average moisture content of kernels at home being approximately 5 per cent.

In a few cases, the kernels were found to have been attacked by insects, due either to old rice sacks having been used in making the small storage bags or to infection from a sample taken on one estate where a large heap of old insect-ridden kernels was found.

Since insect-attack of palm kernels has not been noticed previously and is probably due to the fact that in order to reduce expenditure estates are now packing kernels in second-hand rice sacks instead of new sacks, the insect-ridden kernels were excluded from the tests, although they were tested separately for determination of the acidity of oil.

Results of Analysis.

Since it is well known that the colour both of the testa and the flesh of the kernel is affected by the particular treatment adopted at certain stages of the factory process, (i) sterilisation of the bunches or the clean fruit, (ii) drying of the nuts preparatory to cracking, the results of analysis given in the table have

RESULTS OF COMPARATIVE TESTS OF MALAYAN AND WEST AFRICAN PALM KERNELS.

Country of Origin.	No. of Groups.	Colour of Testa	Colour of Flesh of Kernel				Acidity of expressed Oil. (calculated as lauric acid per cent.)		
			Proportion of white kernels.		Proportion of off-colour kernels.		Maximum	Maximum	Average
			Maximum per cent.	Minimum per cent.	Average per cent.	Average per cent.			
Malaya	A	1			75 54				0.1 0.8
Malaya	B	3	85 82	50 50	64 62	50 50	15 18	1.6 1.5	1.7 2.0
Malaya	C	4	95 95	68 65	83 81	82 35	5 5	1.9 2.8	1.5 2.3
Malaya	D	5	99 99	79 72	90 84	51 28	1 1	1.9 3.1	1.0 2.1
West Africa, Bulk sample.		Dark colour comparable with Malaya C. & D.			57				5.9
West Africa, Sierra Leone sample.		Light colour			82				2.4
West Africa, Port Harcourt sample.		Light colour			92				2.2
West Africa, Sapele sample.		Light colour			76				2.5

N.B. The figures in italics are for the stored kernels and correspond to those for the fresh kernels given above in each case.

been classified according to the variations in those parts of the process, estates practising similar treatment being grouped together as follows :

Serial Group	No. of Estates.	Essential Details of Process.
Letter.		
A	1	(i) Sterilisation of fruit bunches under steam pressure, 40 lbs. per sq. in.
		(ii) Artificial drying of nuts.
B	3	(i) Sterilisation of fruit bunches under steam pressure, 40 lbs. per sq. in.
		(ii) Air-drying of nuts in heaps.
C	4	(i) Sterilisation of fruit under slight steam pressure.
		(ii) Air-drying of nuts in heaps.
D	5	(i) Sterilisation of fruit with open steam.
		(ii) Air-drying of nuts in heaps.

Observations on Factory Process.

Bunch sterilisation, which is the method at present adopted on all large oil palm estates, consists in heating the bunches in a sealed vessel for approximately one hour under a steam pressure of 40 lbs. per square inch with the primary object of loosening the fruit and facilitating separation in the mechanical bunch stripper.

The method of sterilising the fruit under slight steam pressure has been adopted by certain estates in preference to the original method of treating with live steam, in order to prevent the wastage of steam occurring when the fruit is merely steam-heated in vessels without tightly-fitting lids.

As is well-known, the effect of heating under pressure results in the temperature being raised, in the case of a steam pressure of 40 lbs. per sq. in. the temperature would be approximately 140°C., for 10 lbs. per sq. in. 112°C. If live steam is used the temperature will not rise above 100°C., the boiling point of water.

The artificial drying of the nuts is usually effected by exposing the clean nuts from the depericarper to the action of the hot flue gases from the boiler furnace, the nuts moving along a conveyor during the operation. In view of the variation in the temperature of the flue gases, such a method calls for close supervision on account of the possibility of exposing the nuts for too long a period to an excessive temperature with consequent discoloration of the kernel.

The method of drying nuts in heaps* consists in storing the clean moist nuts from the depericarper in heaps in an airy shed protected from rain for 10 to 12 days. During this period a certain amount of heating occurs and the nuts, with the exception of those in the top of the pile, dry. While in this method the degree of heat is not so great as in the artificial method, the period of heating is much longer. In this connection, also, it is important to note that the nuts should not be heaped for more than 12 days, a longer period of storage

* *Malayan Agricultural Journal*, Vol. XVII, No. 10, p. 367.

resulting in an increase of discoloured kernels.

Consideration of Results of Analysis.

Colour of Testa.—The results of analysis show that the colour of the testa of Malayan kernels is darker than the West African. Further, there appears little doubt that the darkening of the testa can be correlated both with the pressure at which the bunches or the fruit are sterilised and the artificial drying of the nuts.

In this connection, experiments carried out in this laboratory have shown that if the clean nuts are heated to a temperature of 140°C for a period of half an hour, both the testa and the flesh of the kernel tend to darken. Although the comparison is not strictly accurate, seeing that nuts were used in the experiment, it is reasonable to suppose that a similar tendency to darken would be noticeable in the case of bunches or fruit heated under pressure. The darkening would also become more marked if the nuts were exposed to excessive heat in the artificial dryer.

It must be admitted, however, that even when the fruit is sterilised with live steam and the nuts dried by exposing them on a cement floor to the sun, the proportion of kernels having light-coloured testas compares unfavourably with that found in the best West African samples. It appears, therefore, that the colour of the testa of the Malayan kernel, even when extracted under the optimum conditions, is darker than that of the West African.

The darkening may possibly be due to some inherent feature of the local fruit, such as, for example, the higher proportion of pericarp with its corresponding increase in the amount of fruit juices containing gummy and other water-soluble organic substances. These juices may darken on heating, possibly interacting with the material composing the shell, penetrating through the latter, affecting thereby the colour of the testa. This possibility will be referred to again when discussing the colour of the kernel.

It is also possible that owing to the naturally firm adherence of the testa to the inside of the shell, any darkening of the material composing the shell on heating, might cause a corresponding darkening of the testa, especially in view of the moist nature of both shell and kernel.

It is difficult to suggest a remedy for this darkening, which is due to the somewhat different policy regarding the treatment of oil palm fruit adopted in this country compared with parts of West Africa, the primary object of every Malayan estate being to obtain the maximum recovery of high quality oil. It is out of the question to suggest any modification of the present sterilisation procedure which is undoubtedly the most essential feature of the whole process.

As far as could be judged there was no tendency for the testa to become darker on storage.

Colour of Flesh of Kernel.—With regard to the colour test for the flesh of the kernel, the results of analysis show that sterilisation under pressure, together with artificial drying of the nuts, is apt to affect the colour considerably.

The darkening may be due to two causes (i) a slight decomposition of the kernel owing to the relatively high temperature (ii) penetration of coloured fruit juices and palm oil into the kernel.

There is little doubt that the temperature of sterilisation affects the colour since, in addition to the experiments carried out with nuts referred to previously, other investigations have shown that with increase in pressure there is also a progressive increase in the degree of discoloration of the kernels. For example, if fruit is sterilised at a steam pressure of 30 lbs. per sq. in. ($130^{\circ}\text{C}.$) the proportion of discoloured kernels is negligible, with the steam pressure at 40 lbs. per sq. in. ($140^{\circ}\text{C}.$) there is a fair proportion of brownish kernels, while raising the steam pressure to 50 lbs. per sq. in. ($150^{\circ}\text{C}.$) results in practically 100 per cent. discoloration.

It is unfortunate, therefore, that it should be necessary to treat the fruit bunches with the steam pressure at the critical point in order to ensure satisfactory separation of the fruit and to assist in the loosening of the kernel within the shell.

Further, it is well-known that in sterilisation, especially under increased pressure, diffusion of both fruit juice and oil into the kernel may occur. For example, in the case of the sample in Group A 15 per cent. of the kernels were definitely stained with palm oil.

The effect was particularly noticeable when bunch sterilisers of the vertical type were used, especially in the fruit in the bunches at the bottom of the steriliser. The full effect of the superimposed mass of bunches was obtained and there was also the additional chance of the kernels being affected on account of the fruit being immersed in the mixture of oil and condensate collecting there.

In order to eliminate the action of the iron on the fruit juices resulting in a considerable darkening of the latter it was proposed at one time to galvanise the linings of sterilisers.

In Sumatra it is stated that a remedy for the discoloration is to be found in the application of a vacuum after sterilisation, the vacuum being induced by means of a steam jet. This also has the effect of reducing the moisture content of the material, and the somewhat dark condensate issuing from a steriliser shows that such treatment probably removes a certain proportion of the soluble colouring matter. Experiments on these lines will be carried out.

The application of vacuum is, however, really only practicable if the press system is being used for the subsequent treatment of the fruit. It would not appear to be an economical proposition in the centrifugal system to remove moisture, when at the next stage of this process, the digestion of the fruit, large quantities of steam must be injected to assist in the disintegration of the mass.

If the fruit is sterilised at low pressure or treated with open steam, the percentages of off-colour kernels compare favourably with those found for the West African samples.

Further, the results also show that the colour of the kernels is unlikely to be affected to any considerable extent by drying the nuts in heaps, provided that

clean nuts are piled and heaps are not allowed to remain for more than 10 to 12 days before breaking.

With the exception of the single sample in Group A, the percentage of off-colour kernels shows no tendency to increase on storage. It is thought that in the case of this sample the increase is due to the discoloration becoming more marked as the kernels dried. The moisture content of the fresh kernels was approximately 14 per cent., while that of the stored kernels was between 8 and 9 per cent. Further, most of the kernels adjudged off-colour were only very slightly discoloured.

Acidity of Oil.—The figures for the acidities of the oil from both fresh and stored kernels, call for little comment, being well within the range of the best West African samples. A noticeable feature of the series is the extremely low acidity figure for the oil from the estate in Group A.

A large increase in the acidity of the oil after storage of the kernels was not expected on account of the very small proportion of broken kernel present in average Malayan consignments. This is due partly to the grading of the nuts before cracking and partly to the practice on estates of selecting kernels before packing, all fragments of shell and badly broken kernels being removed.

As regards acidity of the oil, the figures for insect-ridden kernels were in all cases considerably higher than those for good kernels, the average figure being approximately 4 per cent., calculated as lauric acid.

Remarks and Conclusions.

Since external colour appears to be an important criterion in assessing the value of kernels, it must be admitted that Malayan palm kernels do not reach the standard of the best West African consignments.

The internal discoloration of the Malayan palm kernel is due to the degree of heat to which the fruit is subjected at certain stages of the process, the primary object of which is undoubtedly the maximum recovery of palm oil, the more valuable of the two constituents of the fruit. By reducing the degree of heat the quality of the local kernels as regards this factor compares favourably with that of West African consignments.

It is possible that the tendency to discoloration is more marked in local fruit than in West African on account of the higher proportion of pericarp in the former.

Suggestions are offered for improving the colour of the local kernels where it is difficult to avoid the development of discoloration, but it is doubtful whether the adoption of the method is practicable in view of the subsequent treatment.

The acidity of the oil does not appear to be affected by the discoloration.

The investigation has shown the possibility of the kernels being attacked by insects due to second-hand sacks being used for packing. Damage by insects can be avoided if all sacks before use are sterilised with steam, preferably at a high pressure.

ANNUAL VARIATION IN COCONUT CROPS

BY

H. W. JACK.

Economic Botanist.

Annual or seasonal variation in fruit crops has been experienced in every country and is generally accepted by agriculturists and investors as inevitable. The amount of variation which is found with any particular crop fluctuates considerably according to environmental conditions, of which soil and climate are the main factors.

The variations in the coconut crop from year to year are of vital interest to estate managers who endeavour to forecast crops, to estate directors and investors as affecting dividends, and to various agencies connected with the treatment or transport of copra, and consequently these few notes may be useful as well as interesting.

For the most part, coconuts are cultivated commercially only in those regions near the equator where weather conditions are fairly equable, and a year elapses between the fertilisation of the coconut flower and the full maturation of fruit, so that the fruit is exposed to weather conditions for a much longer period than most commercial fruit crops grown in temperate or even in tropical countries and is therefore probably not so dependent on immediate weather conditions at any one time as those crops the fruit of which ripens in a much shorter period. Hence, coconut crops show a smaller annual variation owing to the comparative evenness of the climates in which they are grown, than most fruit crops cultivated in the more variable weather conditions, which are so characteristic of temperate regions.

Thus, in Ohio, (1) production records show that the average annual variations of the apple crop for the ten year periods 1908-17 and 1917-26, were 46 and 39 per cent. respectively, of the mean crops for those periods. Similarly, in a tropical country such as Trinidad, (2) the cocoa crop on an estate, for the period 1914-29 showed an average variation of 25 per cent. from the mean, which is a much higher figure than the coconut crop in Malaya, probably partly due to the fact that the cocoa pod ripens within six months after the fertilisation of the flower.

The average annual variation in copra production in Malaya (600,000 acres under coconuts) from large areas is indicated in Table 1, which gives the net annual exports of this commodity for nine years, the mean export, the deviations therefrom and the mean deviation which, expressed as a percentage of the mean export, is 6.9 per cent.

Table 1.
Variation in Exports of Copra and in Average Production of
Copra Per Acre.

YEAR.	Annual net exports of from copra Malaya.	Difference from Mean.	Average production of copra per acre from 30 estates.	Difference from Mean.
(1)	(2)	(3)	(4)	(5)
	Tons		Pikuls	
1922	104,588	6,217	7.88	1.00
1923	96,657	7,684	8.79	.08
1924	91,877	6,464	7.87	1.01
1925	96,544	1,787	8.51	.37
1926	104,653	6,312	8.81	.07
1927	86,649	11,692	9.85	.97
1928	95,091	3,250	8.67	.21
1929	112,698	14,357	9.54	.66
1930	102,330	3,989	10.01	1.13
Total	885,067	61,752	79.93	5.50
Mean	98,341	6,861	8.88	.55
Percentage of Mean		6.9	Percent of Mean	6.2

Variations in the net exports may be due to factors in addition to those affecting yields, such as price of the commodity, supplies from other countries etc., but local production should always be the dominant factor and hence the exports reflect, to a fair extent, the annual variation in cropping. In the same Table, the average production of copra per acre per annum from thirty estates under European management representing some 56,000 acres distributed over the main producing areas in the Federated Malay States is given in pikuls (1 pikul = 133½ lbs.) as well as the mean production over the whole period

The annual differences from the mean production are shown in column 5 as well as the mean of those differences which is 6.2 per cent. of the mean yield per acre, and approximates to the figure already given for variation in net exports. The increasing age of the palms on the estates, together with the tendency for copra prices to drop, coupled with efforts to increase production indicate a slight upward trend in the average production which possibly slightly magnifies the variation due to seasonal causes during the period under consideration. On the other hand, the estates cover such a wide range of variable environmental and seasonal conditions that the cropping variation is probably modified to such an extent as to outweigh the factors tending to increase yields. Hence the variation shown (6.2 per cent. of the mean) affords a fair indication of variation over large and widely distributed areas and is, of course, liable to be greater or less than the mean in any year, so that between any two consecutive years there may be a variation of approximately twice the amount shown, as was indicated by the writer (3) several years ago.

Table II.
Annual Yield of Fruits per Palm from Row 9 Palms 1-12
of the Experimental Area.

Palm No.	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	Mean	Total deviations from Means	Average deviations from Means	Average deviations as % of Means.
1	71	67	41	74	57	77	62	65	77	72	66	81	8.1	12.3
2	76	54	55	53	45	74	57	64	60	73	61	85	8.5	13.9
3	100	71	87	95	82	92	84	106	87	103	91	85	8.5	9.3
4	63	44	58	51	60	58	38	40	41	39	49	88	8.8	17.9
5	80	83	98	89	59	73	70	77	64	62	75	99	9.9	13.2
6	109	75	78	77	62	53	71	91	58	77	75	96	9.6	12.8
7	122	91	66	105	54	90	92	110	113	91	93	152	15.2	16.3
8	79	58	91	74	93	76	71	87	88	99	82	100	10.0	12.2
9	63	60	43	45	40	38	47	60	73	61	53	104	10.4	19.6
10	74	50	63	61	54	74	46	82	60	54	62	93	9.3	15.0
11	52	51	62	57	68	65	60	77	77	62	63	69	6.9	10.9
12	73	68	66	64	63	57	55	63	52	73	63	54	5.4	8.6
Totals	962	772	808	845	737	827	753	922	850	866	69	92	9.2	13.5
Average per ann.	80	64	67	70	61	69	63	77	71	72	69	44	4.4	6.4

Table 2 shows the individual yields of fruits recorded annually from twelve consecutive mature palms growing in a line under good average estate conditions for ten years. The mean yields are given in column 12. In column 14 the average deviations from the mean yields are shown and these are expressed as percentages of their means in column 15, which shows a range of from 8.6 to 17.9 per cent. with an average of 13.5 per cent.

At the bottom of this table the average annual yields from the group of palms are given, as well as their mean for the period, the deviations therefrom and the average percentage deviation from the mean is shown to be 6.4 per cent. Thus, for individual palms growing under good conditions, the average annual variation in yield is shown to be 13.5 per cent. of the mean yields; whereas if considered as a group, the average annual variation is only 6.4 per cent. which very closely resembles the variations shown in Table 1. Many other groups of palms on the experimental area for which figures are available could have been chosen with similar results. Incidentally, the Table also shows that individual palm yields are fairly constant over a long period. In the case of individual palms selected as high yielders, ten scattered palms on the experimental area having an average of 97 fruits per palm per annum over a period of ten years, gave a slightly higher average variation amounting to 14.4 per cent. of the mean yield. This tendency for variations to increase according as yields increased has already been recorded (4).

In Table 3, the annual crops in ripe nuts per acre from long-established blocks of palms on four estates situated in three different areas representative of the main commercial copra-exporting districts of Malaya, are shown. The estates concerned were chosen for several reasons. They fairly represent the varying conditions of soil and water-table in our oldest established commercial coconut areas, they are known to be high-yielding estates, they are under European management, and the managers in charge of them are noted for their keenness and reliability, so that the figures provided by them are comparable and accurate within the limits of practical estate work. The yields are given for the longest periods possible in each block and are all from mature bearing areas only. The mean yields per block, the average annual deviations from those means in numbers of nuts per acre and as percentages of the mean, are shown for each block, and the mean percentage deviation of all the blocks is found to be 10.44 per cent. (with a range of from 7.5 to 15.9 per cent.) Thus, the average annual variation in cropping on well-managed estates under good conditions, as judged from the data in this Table, is less than 11 per cent. of the mean yield over fairly long periods. Again, this variation may exceed or be less than the mean by this average amount, so that in consecutive years there may be differences in actual crop of approximately twice the average or even more as can be seen by comparing the yields in estate C, block 2, for the years 1916 and 1917 where there is an increase in crop in 1917 over 1916 of approximately 21 per cent. Incidentally, this table also shows that excellent crops are maintained under local cultivation conditions (alluvial clay soils) for at least twenty years after the

Table III.

Annual Crops in Nuts per Acre from Estates.

Block	Estate A.			Estate B.	Estate C.				Estate D.
	1	2	3	1	1	2	3	4	1
Area	Acres 52	Acres 56	Acres 47	Acres 75	Acres 103	Acres 294	Acres 211	Acres 315	Acres 253
Planted	1903	1907	1909	1910	1900	1901	1902	1906	1911
1913	—	—	—	—	3616	3746	2966	—	—
1914	—	—	—	—	3745	4147	3263	—	—
1915	—	—	—	—	3314	3392	2775	—	—
1916	—	—	—	—	4002	3772	3362	2827	—
1917	4028	3364	—	—	4496	4574	3950	2774	—
1918	4282	4484	3689	—	4475	4408	3233	2524	—
1919	3782	3420	2343	—	2819	3029	2969	2932	—
1920	3136	3517	2877	2758	3642	4068	3771	3359	2921
1921	5478	4559	4073	3029	4930	3974	3439	2882	3235
1922	4147	3711	3668	3735	3818	3907	3909	3124	3401
1923	4077	3609	3704	3264	4215	3849	3423	3387	3079
1924	4586	4847	5010	2737	3084	3605	3269	3306	3284
1925	4488	4406	4400	3246	3561	3591	4046	3032	3634
1926	4654	5093	4676	2929	3449	3721	3547	2863	3614
1927	3955	4223	4183	2966	3345	2933	3291	3000	3447
1928	3370	4763	5158	3346	4445	3056	3315	3015	4042
1929	4254	3933	4722	3740	2796	3017	3144	3692	3709
1930	4521	4852	4791	3352	3134	3012	3270	3227	3825
Total	58758	58781	53294	35102	66926	65801	60942	45947	38191
Mean	4197	4199	4100	3191	3718	3656	3386	3063	3472
Average deviation from M.	412	520	653	280	487	401	265	229	266
Percent. average deviation M.	9.8	12.4	15.9	8.8	13.1	11.0	7.8	7.5	7.7
Total percentage deviations from means = 94.0					Mean percentage deviation = 10.4				

palms have become mature, with, as yet, little sign of diminution in yields. Thus, it has been shown that, in large areas of coconuts, as may be gauged from the copra exports and from the average yields of a fair number of well-managed estates, there is an annual variation in yield approximating to 6 to 7 per cent. of the mean over a fair period. Individual estates show an annual variation of 10.6 per cent. with a range of from 7.5 to 15.9 per cent. of their mean production, while individual palms exhibit a mean annual variation of 13.5 per cent.

Variations of the order described cannot be considered as large and consequently, it may be said that, on the whole, coconut crops in Malaya are fairly steady as compared with many other fruiting crops, and that under fair average

conditions of cultivation, they merit, as far as production is concerned, the title of "Consols of the East", though the last few years have shattered sadly their claim to that title in relation to market prices.

Summary.

1. The average annual variation in copra production in Malaya is shown to be 6.9 per cent. of the mean production (98,341 tons).
2. The average annual production of copra per acre on large estates is shown to vary by 6.2 per cent. of the mean production (8.88 pikuls)
3. The average annual variation in production of ripe nuts per palm per annum is shown to be 13.5 per cent. of the mean production per palm.
4. The average annual variation in production of ripe nuts per acre from large estates is approximately 11 per cent. of the mean production per acre.

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A MOLE—DRAINING EXPERIMENT

BY

N. H. SANS,

Attached to Department of Agriculture, Kedah.

The quick removal of rain-water from aerodromes, race and golf-courses without interfering with, or damaging, the surface of the soil is often most desirable, especially during the periods of the year when the rainfall is heavy.

An experiment, with the object of running off surplus water rapidly from the surface of the large aerodrome at Alor Star, is being carried out by the Public Works Department, Kedah by the method known as mole-draining.

The Alor Star aerodrome covers an area of over 1,000 yards by 1,000 yards and is regularly used by both heavy and light aircraft. It is almost level, there being a slope of only 4 feet from north to south. The subsoil is a stiff clay. The surface of the soil is somewhat lighter and has consolidated well. After heavy monsoon rains water collects on the surface to a depth of 1—3 inches, and owing to the slight slope and plastic nature of the soil, natural drainage is very slow. In view of the above-mentioned conditions it was found necessary to drain the land artificially.

At the outset large open drains were constructed along each side of the area and a large subsoil drain diagonally across it. From the latter, secondary subsoil drains were made and between these, mole-drains were run 30 feet apart and 8 inches to 1 foot deep. The mole and the main sub-soil drains empty water into the large open side drains which surround the aerodrome.

The system of mole-draining consists of drawing a steel bullet or "mole" some 2 inches in diameter and 16 inches long through the subsoil in a horizontal direction, thus forming a small tunnel through which water can pass.

The details of the construction of the implement are as follows :—

Two parallel iron bars 7 feet long are attached to each other, side by side, and slide on the surface of the soil. Between these a thin disc-coulter is attached which cuts through the soil to a depth of 6 inches only. Behind this there is a vertical blade, at the base of which the mole is fixed.

A series of holes in the blade enables the mole to be set and the drains made at the required depth. Attached to the blade and the base of the handle is an adjustable rod which ensures that the blade is held in a vertical position. The handle is held in check at the base so that it cannot move forward, but when it is desired to run the drainer out of the soil, the handle is forced backwards and the mole is gradually drawn to the surface.

Three small wooden rollers, each 9 inches in diameter, are fixed to the implement, two being placed in front and one behind.

It is stated that a draw-bar pull of some 3,000 lbs. is required to draw the drainer through the soil, and this power is obtained from a light tractor with a steel-wire hawser and winch.

When starting drainage operations, the mole is inserted at the side ditch and the tractor proceeds ahead paying out 100 yards of cable. The tractor is then jacked up quickly by a simple device and anchored. The engine turns the winch slowly and winds in the cable, thus drawing the mole through the soil. The whole process of inserting the mole and winding in the 100 yards of cable takes about 10 minutes. When one of the main drains is reached, the mole is run out and the whole implement is then lifted into the tractor and carried back to the side drain at the required distance from the drain last made.

No soil is removed in the process and the surface of the land is not disturbed. It is important to note that the cut made by the coulter and blade is not intended for the passage of water from the surface to the mole-drain. Under normal weather conditions this small opening should close, otherwise there is danger of the drain being blocked by falling earth. The back-roller already referred to assists in closing the small cut.

The shallower the moles are run the sooner do they run off surface water, but they are more liable to collapse under heavy pressure. A depth of drainage of 14 to 16 inches with drains 6 to 21 feet apart is usually considered to give the best general results. At these distances the mole-drains can be run up to 200 yards long, but the slope of the land must, of course, be taken into consideration when laying out the scheme of operations.

Care should be taken to see that the outlets of the mole are kept open, and a good idea is to insert in them a short length of piping. At the aerodrome this was at first not done and a number of the outlets quickly choked.

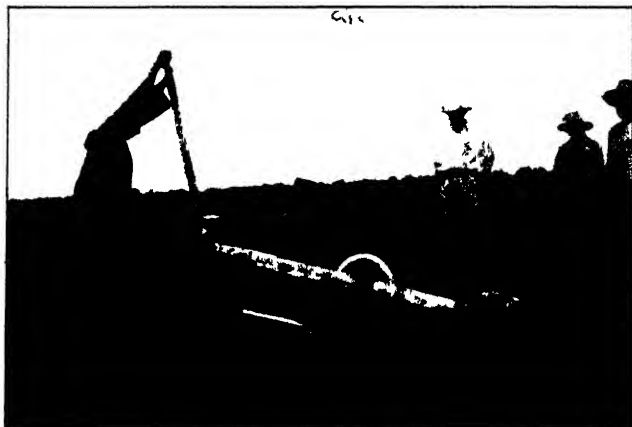
The best time for mole-draining is when the surface soil is dry and the subsoil wet. Again, unless the moles are run at least 2 to 3 inches deep in a stiff subsoil they will not last long.

Moles up to 6 inches in diameter are sometimes made at depths of 20 inches to 30 inches, but considerably more power than can be obtained from the average tractor is required to make them.

The cost of the whole equipment, that is, tractor, mole-drain, and accessories used at the aerodrome was \$2,300. The mole-drainer with cable costs about \$300. The cost of working the equipment per day of 8 hours is \$7.50 and the cost per acre is \$2.30 with drains 30 feet apart and 8 inches to 1 foot deep. These costs may be reduced when further experience in handling the equipment is obtained.

In conclusion, it can be stated that mole-draining can be effectively carried out on areas such as described, and that with closer drainage than that at present practised at the aerodrome—namely 15 to 20 feet as against 30 feet, a greater measure of success will be obtained.

The writer is much indebted to Capt. G. Walker, O.B.E., M.C., State Engineer and Mr. C. E. Jenkins, Senior Executive Engineer, Kedah, for information regarding the drainage scheme and for the facilities given him for witnessing the work in progress.



SIDE VIEW OF THE MOLE-DRAINING IMPLEMENT LIFTED
TO SHOW ITS GENERAL CONSTRUCTION.



THE MOLE-DRAINER IN OPERATION.
NOTE, THERE IS LITTLE DISTURBANCE OF THE SURFACE OF THE SOIL.

Abstracts.

THE CANNED PINEAPPLE INDUSTRY IN HAWAII*

Pineapple plants were successfully introduced into Hawaii in 1809, but it was not until 1885 that a number of varieties were introduced, amongst which the Smooth Cayenne proved so superior, as to lead almost to the exclusion of all other varieties.

In view of the fact that Hawaii is some 2,000 miles from the nearest United States port, it was practically impossible to find a sufficiently large market for the fresh fruit, in consequence of which the first canning venture on the islands was instituted in 1892.

Seven years later, the initiative of one man led to an extension of this small industry, the subsequent rapid development resulting in the Hawaiian Pineapple Company being inaugurated in 1901. Other companies soon followed the lead, until by 1912 the production exceeded consumption. In that year, the "Association of Hawaiian Pineapple Packers" was formed mainly for the purpose of strengthening the market conditions for canned Hawaiian pineapples through united advertising.

This move resulted in increased consumption; the development of the industry surged ahead until in 1930 nearly 13,000,000 cases, each of which contains an average of two dozen cans, were produced.† The American Can Company supplying cans for all the industry reports a consumption of 45,000 tons of tinplate in 1930.

The main crop is obtained from six of the main islands of the group, namely Kanai, Oahu, Molokai, Maui, Lanai and Hawaii, the total area under the crop being 78,000 acres.

The pineapple plant "possesses a relatively high moisture content and nutrient absorbing capacity in its leaves and axillary roots. Its adaptability to environmental changes may be judged from the fact that in Hawaii it is grown successfully in altitudes varying from nearly sea-level to 3,000 feet, in regions of rainfall from 15 to 100 inches a year, in temperatures that vary from 45°F to 100°F and in varying sunlight intensities as well as numerous soil types. The best pineapples, however, and by far the majority, come from regions of equitable climate, between the altitudes of 500 and 1,500 feet".

Early attempts to foster better pineapples by means of irrigation were unsuccessful, mainly because the plants suffered from stagnation or overabundance of soil moisture. It has been shown that the pineapple is an efficient user of water. It requires only 25 lbs. of moisture to build up 1 lb of dry matter.

* An Abstract of an article by Norman King of the Association of Hawaiian Pineapple Cannerymen, published in *Tin*, November, 1931

† The Malayan production for 1930 was 1,618,919 cases of 4 dozen cans per case so that Hawaiian production is nearly four times that of Malaya.

Considerable preliminary cultivation of the land is practised in Hawaii before planting the crop. Leguminous and other crops are also grown for a period of one or two years between crops of pineapples to rejuvenate the soil and are then ploughed in.

Before planting, long strips of heavy tar paper mulch are laid over the fertilised beds. Approximately 24 such rolls, varying in width to suit different requirements, between 36 inches and 54 inches wide, are required per acre. The purpose of paper mulch is to prevent excessive growth of weeds, to conserve moisture when it is scarce and to shed it when rainfall is excessive, and to increase the temperature of the surface soil during the early stages of growth and thus accelerate plant development.

The planting operations are done by hand. A hole is made through the paper 8 inches into the soil and the "seed piece" is thrust therein. In this way 15,000 to 20,000 plants per acre are set.

Manuring is an important feature in Hawaiian pineapple cultivation. As a general rule, 0.1 lb. per plant of a complete fertiliser is applied under the paper at planting time, an equal quantity, if not more, applied subsequently, either in the ground, or more commonly in the basal leaf axils of the plant. The latter system is recommended.

Thus 3,000 to 4,000 lbs. of fertiliser per acre are required. This appears excessive, but is not so considered in view of the heavy first crop obtained of 30 tons per acre, while close on 50 tons per acre has been known.

It has been found that the pineapple plant responds to iron salts. Consequently, scrap iron is treated with sulphuric acid, forming iron sulphate crystals, which are dissolved in water and sprayed on the plants as a dilute solution.

The pineapple crop in Hawaii is subject to various pests and diseases, amongst which heart-rot, thrips and "wilt" are mentioned.

Approximately 80 per cent. of the fruit ripens in July, August and September. In order that the fruit may be "picked ripe and canned right", the utmost speed in transportation from the fields to the canneries is necessary.

Special machinery is used for the treatment and canning of the fruit and the utilisation of the waste to ensure that the factory work shall keep pace with the heavy crop in the season.

The Association of Hawaiian Pineapple Canners has inaugurated an Experimental Station, staffed with a number of specialists. In a few years they have "contributed substantially to a knowledge of soil and plant compositions, insect associations and control, the development of new and more resistant varieties of pineapples, root damaging nematodes, plant assimilabilities and growth habits, and pathogenic organisms injuring pineapples. The department of agronomy conducts field experiments with an eye to determining field applicability of laboratory findings."

THE WHALE OIL INDUSTRY IN 1931.

Regarding the heavy competition last year with whale oil against palm, coconut and other vegetable oils, it is interesting to note that, according to the Cape Town correspondent of the (London) *Morning Post*, this newcomer should be less aggressive during the coming season, as we are told—

“A comparatively small fleet of whaling vessels will proceed to the Antarctic this season from Cape Town, which is now the centre of the world’s whaling industry. Only three companies will operate this year, the total fleet comprising seven factory ships and about forty whale-catcher ships. Last year the fleet consisted of forty-five large factory ships and more than 200 catchers—the largest whaling fleet ever assembled. The Norwegians decided not to participate this year owing to the whale-oil glut. At least one company has gone into liquidation.

“Hundreds of skilled whale-fishers are now idle in Norway, and it is more than probable that when the big fleets again sail into the Antarctic next year the harpoon gunners, who made small fortunes in the past, will have to accept a lower rate. Indeed, this has already come into operation, and many of the gunners who have just sailed in the small fleet this year have signed on at only £3. 15s. for each blue whale they shoot, as against £6 in the old days. Even so, however, with a catch averaging 200 whales for each ship they will still be able to earn a sum for their seven months’ work far in excess of the average liner captain’s yearly pay.

“The three companies who are operating this year are mostly catering for the private requirements of various soap-making concerns, and it is expected that only about 50,000 tons of oil will be needed. This will mean the killing of approximately 3,000 whales—a small number when compared with the 40,000 that were slain last year. The reason for this terrific slaughter was that the Antarctic fields were comparatively new, and it was feared that the whales would soon vanish. Thanks to recent scientific expeditions, however, it is now known that the whales exist in large numbers all around the South Polar Regions, and there is no fear of a shortage for many years to come. In future, therefore, it is likely that only sufficient oil to fulfill the world’s requirements will be taken to avoid over-production”.

Those words “the reason of this terrific slaughter”, reminds one of the hopes advanced by the Vegetable Oil—Producer (without destroying life) that some international arrangement will be arrived at to regulate the massacre of the whales, especially during the breeding season or in certain waters, some say the tropical seas, where the whales go to have their offspring. Failing such measures it is reckoned that a few more seasons like the last will see the end of the whale, and hence of their competition with vegetable oils.

Tropical Life November, 1931.

MALAYAN AGRICULTURE AT UNITED KINGDOM EXHIBITIONS, 1931.

The following abstracts from reports recently received indicate the valuable work performed by the Malayan Information Agency in giving publicity in the United Kingdom to the agricultural products of Malaya.

The Imperial Fruit Show, 1931.

This year the Imperial Fruit Show was held at the City Hall, Manchester, from October 30th to November 7th, and attracted large crowds each day.

The Malaya stand, as in previous years, was in the Empire Marketing Board section. The space was devoted to demonstrating Malayan canned pineapples.

Apart from the interest shown in the stand by the general public, a very satisfactory volume of enquiry for pineapple came from grocers of Lancashire and Cheshire and many of these were put into direct touch with the importers.

The cookery demonstrations given at the stand daily were not confined to the use of Malayan pineapple in the concoction of sweets, but were designed in even greater measure, as on previous occasions, to teach the public how savoury dishes can be improved by the addition of a little pineapple.

A special feature this year was the introduction of a few demonstrations specially intended to popularise Malayan tapioca. Talks were given from the stand, at frequent intervals, both on pineapples and tapioca.

Sample tins of pineapples and receipt-booklets were on sale to the public. Fifty cases of pineapples were sold and used for demonstration purposes, while the receipt-books met with a ready demand.

One of the most gratifying features of the Show was the large share of attention secured in the Press by the Malayan exhibits. Also, the stand received a most satisfactory amount of attention in a wireless talk on the Fruit Show, and a large number of visitors mentioned that they had been attracted there by the account of the activities of the Stand given in the wireless talk.

To sum up, it is felt that the Imperial Fruit Show of 1931 was the most successful one in which the Malayan Information Agency has hitherto participated, both from the point of view of general publicity and from that of the benefit which seems likely to accrue to the pineapple trade as its outcome.

International Grocers' Exhibition, 1931.

This exhibition was held at the Agricultural Hall, Islington, from September 19 to 25.

Malaya was represented by a small stand in the Empire Marketing Board Section, devoted to a display of Malayan canned pineapples, exhibited in the fullest possible variety of packings and labellings, the supplies being kindly provided free of charge by five firms.

A new feature this year was the 11 lb. size tin of round cut Golden quality slices in water, a packing specially put up to meet the requirements of restaurants.

A comprehensive range of samples of Malayan tapioca were also exhibited.

Probably owing to the fluctuations then taking place in Sterling, business on the opening days was not too good. Later, however, the business transacted on the stand became easily double that of last year. Whenever possible, the enquirers were persuaded to put through their orders on the spot, and in view of the anticipated tariffs it may reasonably be presumed that the majority of these orders will have matured. Some of the enquiries involved special outsize packing.

The Southend Carnival.

This festival was held from the 25th to the 29th August inclusive. The Empire Marketing Board staged an Empire display in a marquee, in which Malaya occupied a fine stand in a commanding position.

The Malaya stand was devoted chiefly to the display of Malayan canned pineapples. Sample tins were distributed to the public, accompanied by a booklet describing the production and canning of the fruit in Malaya and the booklet of 50 recipes for cookery with the aid of pineapple.

That the public was exceedingly responsive is proved by the fact that 32 cases of pineapple were disposed of, the stand exhausting its supply on several occasions.

Two cases were used for demonstration purposes to shew the quality and to allow the public to have an opportunity of testing the fruit.

Hitchin Civic and Empire Shopping Week.

Throughout the duration of this festival, an exhibition was held at the Hitchin Town Hall from September 28 to October 3.

The attendance was large and the visitors enthusiastic, the more so because the Civic Week chanced to synchronise with the abandonment of the Gold Standard and the first rush of fervour for Empire products which followed.

The Malaya stand was attractively decorated. The purpose of the stand was to display Malayan pineapples, of which sixteen different labellings were shewn. A comprehensive exhibit of tapioca was also staged.

Malaya's participation included two addresses in Hitchin on Malayan products, the second of which was at the Town Hall, the speech being relayed through amplifiers to the crowd outside in the streets.

Reviews.

Laboratory Experiments on the Larvicidal Properties of Mineral Oils.

BY

G. H. CORBETT AND E. P. HODGSON,

*Bulletin No. 5 of 1931 from the Institute for Medical Research,
Federated Malay States.*

This publication, which should prove of interest to agricultural workers, records the results of extensive but preliminary laboratory experiments from which certain oil mixtures have been selected for field trials in the control of mosquitoes.

This investigation was commenced as a result of the attention of the Malaria Advisory Board being drawn to the desirability of preparing a standard specification for anti-malarial oils applicable throughout Malaya, whereby the less effective of the heavy oils could be eliminated and a reduction effected in the relative quantity of the more costly components, namely, solar and light oils.

The original samples included nine different oils, two heavy, one solar and six light. Five of the light oils were found to kill most rapidly, except in the case of pupae; the solar was slower in action and the heavy oils yet slower. Of the light oils, one showed a slight superiority over the other and of the heavy oils one was found to be slower in action than the other, thus indicating that oils sold under the same "trade" name may give widely divergent results.

Several experiments were performed in which larvae were tested against films that were exposed to atmospheric conditions for several days. The results demonstrate that the two heavy oils and solar oil, when left undisturbed, remained effective after a fortnight, though less rapidly than at first and that only one of the light oils showed any marked toxicity after the first day.

As a result of these preliminary investigations, experiments were conducted with mixtures which were designed to include all possible practical combinations of the best heavy and light oils and solar oil.

Subsequently, the following four mixtures were selected from these combinations.

- (1). Heavy 2 parts, Solar 1 part.
- (2). Heavy 12 parts, Light 1 part.
- (3). Heavy 3 parts, Solar 9 parts, Light 1 part.
- (4). Heavy 8 parts, Solar 4 parts, Light 1 part.

In a series of experiments, fresh films of these selected mixtures were used and 500 larvae of *A. vagus* were tested against each mixture. In other series, experiments were conducted with films of different ages and with larvae of different species of mosquitoes.

The results of all these experiments are recorded and illustrated in graphical form.

Heavy oil is considered to be the component responsible for the persistent toxicity of a mixture, although a small quantity of solar appears to assist in that direction. Of the anophelines, larvae of *A. vagus* were found to be less resistant than those of *A. maculatus* and *A. hyrcanus*; of the culicines, *Stegomyia* spp. proved much more resistant than the anophelines, while *Culex* spp. succumbed more rapidly than *A. vagus*.

A discussion concerning the results of the foregoing experiments follows in which the evolution of oiling mixtures in Malaya is reviewed. It is suggested that the reasons for the changes in the composition of oiling mixtures in Malaya would appear to be confirmed by the results of these experiments.

In addition to the above, experiments were conducted in order to test the toxicity of the vapour of the oils. The results show that the vapour, if any, from the heavy and solar oils is not toxic to larvae and that the most volatile oils seem generally to be the most rapidly toxic.

Following these experiments, the physical properties of oils in relation to their toxicity are briefly discussed.

The writers summarise the results of these laboratory experiments as follows:—

1. Experiments with oil samples and mixtures prepared from them have resulted in the selection of mixtures for field trials.
2. The larvicidal properties of oils bear little relation to their commercial specification; several oils sold under the same "trade" name gave widely divergent results.
3. Whilst it is impossible at the present juncture to prepare a satisfactory specification for larvicidal oils, based on physical and chemical factors, certain properties have been demonstrated to be of primary importance. These are, viscosity, surface tension, aromatic content, and the retention of toxicity in film form. Volatility is of less importance than is generally supposed.
4. Field experiments, which are in progress, are essential before biological, physical and chemical specifications for anti-malarial oils can be prepared.

(Contributed.)

The Root Disease Problem on Old Rubber Areas in Malaya

BY

A. SHARPLES AND A. R. SANDERSON,

*Bulletin No. 3. Rubber Research Institute of Malaya. 42 pp.,
2 plates. Price \$1. November 1931.*

This bulletin contains new and valuable information on root diseases of rubber especially on the disease caused by *Fomes pseudoferreus* (*Ganoderma pseudoferreum*).

The writers have established that this disease is not necessarily confined to old rubber, but that it occurs also on very young rubber irrespective of any particular soil type or site. The spread of the disease is entirely by underground root contact, and analysis of total root disease cases, in large blocks of trees of different ages, showed that *F. pseudoferreus* is by far a more serious agent of destruction than *Fomes lignosus* or *Ustulina zonata*.

Attention is directed to the serious aspect of root diseases in general—and of *F. pseudoferreus* in particular—as a factor in determining the economic life of Malayan rubber plantations. A replanting scheme is outlined for estates, with areas showing declining yields, where consideration of a future policy is becoming imperative. In this connection, the probable effect of the successful establishment of high-yielding areas, by means of bud-grafting, on future planting policy is pointed out.

It is suggested that the annual writing off of a certain percentage of the planted area against disease wastage will be considered just as necessary an item in the annual budget as depreciation of machinery and buildings.

Full recommendations for treatment according to incidence of disease are given.

A. T.

Annual Reports for 1930, Technical and Field Officers of the Department of Agriculture, S.S. and F. M. S.

Special Bulletin, General Series No. 6 Technical Reports for the Year 1930,

84 pp. price 50 cents and No. 7 Reports of Agricultural Field Officers

for the Year 1930, 116 pp. price 50 cents, post free.

While not attempting to give a detailed account of the research and field work of the Department, the above-mentioned reports give a complete summary of the results achieved during the year under review and of the progress of extended pieces of research work in hand. Full accounts of completed work are published from time to time in the *Malayan Agricultural Journal* or in Special Bulletins of the Department.

The technical reports are nine in number, each containing a record of a Division of the Department *viz.* Agriculture, Agricultural Instruction, Chemistry, Economics, Economic Botany, Entomology, Mycology, Soils and Plant Physiology and Statistics.

There are eleven reports of Field Officers, which embrace the activities of agricultural field research in all the States of Malaya with the exception of Kelantan and Trengganu. Appendices to this volume contain statistical information concerning such subjects as plant importation, plant distribution, land alienation and court cases.

Miscellaneous Articles.

REPORT ON SEGAMAT SAWAH COMPETITION, 1931

BY

G. HAWKINS,

Assistant Adviser, Segamat.

Introduction.

It is stated that Segamat formerly produced much rice and fruit. The rubber boom involved the neglect of other agricultural products and continued so long that the younger generation has never acquired the technique of padi-planting. The rubber slump left the Malays bewildered and their attempts at planting padi were so laborious and unskilful that they are yet to be persuaded that rice and fruits are profitable crops, their own experience being that much labour yields little result. Increasing economic pressure compelled attention to the supply of food and it was considered advisable to stimulate interest by a competition on new lines. The competition was not an agricultural show which encourages the conscienceless collector rather than the real planter but a contest for the best tilled *sawah*.

Prizes.

The generosity of the General Adviser, Johore, and the Executive Engineer, Segamat, made it possible for attractive cash prizes to be offered. There were three first prizes of \$25 each and three second prizes of \$15 each and a prize for the *Penghulu** or *Naib*§ who was most assiduous in encouraging his *anak buah*† to plant. In addition, a certificate was also given to each winner. Thanks to the great assistance of the District Officer, the *penghulus* were circularised early in July and the District Officer transmitted the names of 412 contestants.

Judging.

Judging was done in November, in accordance with a previously notified programme, by the Assistant Adviser in consultation with the Chief Settlement Officer, Che Puntong and the Padi Officer, Che Ahnial. Contestants were told that judging was not from the point of view of yield but of method of planting, i.e. marks were given for uniformity of planting, water control, preparation of divisions and *batas*‡ etc as shown in the Barnes' card. A few copies of the Barnes ¶ card were handed out. The Padi Officer took the opportunity of distributing pamphlets about rats. Judging next year should be in October so as to shift the whole planting programme slightly forward.

* Penghulu=Local Headman. § Naib=Deputy. † Anak buah=People under *Penghulu*.

‡ Batas = bunds.

¶ A copy of this card is published on page 80 of this issue.

Results.

Tenang was easily the best area. The constant encouragement given to planters by Mr. C. Bradbery of North Labis was of the greatest value. The *Penghulu* and his *Naibs* did excellent work and the *sawah** of themselves and of their *anak buah* are comparable to those in the Negri Sembilan where padi planting is regularly carried on. It is said that the Tenang Malays emigrated from Malacca and have planted padi for 100 years. So long as rivers are kept clear and clean, there is no reason why padi should not be planted for another 100 years. No one complained of pests, and in most cases, rat traps, ducks and clearing of adjacent land were manifest.

The most popular variety was Serendah. Planting was late and an early flood may be disastrous. No one had considered the digging of *Kolam*§ where the variety of edible fish known as Sepat Siam could be introduced, but a few thought the experiment could be tried. There was unworked *sawah* land that could be utilised. If *kampung*† land is kept for, and settled by, genuine padi planters, these areas could be again brought under rice. The cause of this neglect is due to shortage of population. Some of the *sawah* is very inaccessible and to reach one area took a 4 hours' walk.

Jementah was uneven. The Legeh valley was very good, but the Jementah valley showed patchiness in area and spasms in the cultivation. It is a long, rich, narrow valley and should yield abundantly, but islands of *blukar*,‡ and haphazard methods lead to attacks of pests which are almost uncontrolled. Much ingenuity had been shown; one Malay had a *kenchir*,* another an ingenious water-course through a tree trunk. A Bengali, several Chinese, Maalafs and Javanese were planting. The *Penghulu* and the *Naibs* are working well, and under present economic conditions, will make a great improvement in 1932.

Pogoh has made a promising start and should improve. A drain constructed by the Public Works Department was very cleverly used as a *tali ayer*.* Jabi was patchy and should improve.

Tebing Tinggi after Jementah and Tenang is the most promising area. A Rembau woman and the *Naib* himself set an excellent example in a newly opened *sawah* capable of ten-fold expansion with good *kampung* land available nearby. The *Naib* is doing very good work and is getting an increasing number of people to concentrate on one large area rather than the opening up of small areas.

Gemas was the worst *mukim* and the small holdings gave full and depressing evidence of apathy and neglect. The *sawah* were few in number, small in area and widely separated. The bad cultivation and subsequent poverty of Gemas may be due to the following reasons:—

- (a) the soil is poor;
- (b) floods that may last for 14 days are an annual occurrence;

* Sawah = wet, padi land. § Kolam = pond.

† Kampung = a small holding or native homestead. ‡ Blukar = secondary jungle.

* Kenchir = water-wheel.

* Tali ayer = small distributing channels for water

- (c) the settlement is said to be over 200 years old and to be of Pahang origin. The people have no great agricultural skill, practise shifting cultivation, abandon their holdings during long visits to Pahang, occupy right up to the river banks and practise wasteful methods of fish catching. Numerous cases were observed of relatively large rice areas in which only a fraction was tilled and the rest abandoned. The planters of the pathetic remnant told the writer that their friends with whom they had opened up the area only a few years ago had gone off and opened up elsewhere. These fissive tendencies are fatal to an essentially colonial enterprise.

- (d) Most of the people have holdings too large for proper tillage.

Whatever the causes, it will take years of constant effort to effect any improvement. As a start, it is proposed to close the land office books for this *mukim* and to call a halt to shifting cultivation.

Considerable interest was aroused and it was pleasant to be able to get into personal touch with padi planters on their own ground. Most planters were present during the judging and the opportunity was taken to impress on them the importance of adherence to a pre-arranged planting programme and of communal and continued effort. That the idea was a success could be fairly claimed. Unusually good weather made the padi in 1931 flourish; it is not unlikely that economic pressure will force still greater attention to *sawahs* in 1932, and perhaps this competition, which stressed the technique of cultivation, may be a solid benefit.

THE BARNERS' CARD. No.

SCORE CARD FOR JUDGING SAWAH.

District..... Mukim..... Kampong.....

Owner's Name..... E.M.R..... Lot No..... Acreage.....

Marks. Very Good 5. Good 4. Very Fair 3. Fair 2. Bad 1. Very Bad 0.		MARKS.	Date and Initials of Judges
1.	Cultivation. Maximum marks 20.		
	a. Preparation of divisions of fields and banks of water courses, freedom from grasses and no waste of water.	.....	.....
	b. Preparation of Sawah, absence of growing grasses.	.....	.....
	c. Absence of busut and shelter for rats.	.....	.....
	d. Clearing of adjacent land.	.....	.....
2.	Transplanting. Maximum marks 20.		
	a. Regularity and distance of spacing.	.....	.....
	b. Number of plants per hill.	.....	.....
	c. Freedom from grasses and weeds.	.....	.....
	d. Rat Control.	.....	.....
3.	Growing period. Maximum marks 20.		
	a. Regularity of growth.	.....	.....
	b. Freedom from grasses and weeds both in sawah and in batas.	.....	.....
	c. Rat Control. Adjacent land kept cleared.	.....	.....
	d. Maintenance of batas and tali ayer banks	.....	.....
4.	Flowering period. Maximum marks 20.		
	a. Uniformity of flowering.	.....	.....
	b. Purity of padi.	.....	.....
	c. Batas clean and well kept and adjacent land cleared.	.....	.....
	d. Rat Control.	.....	.....
5.	Ripening period. Maximum marks 20.		
	a. Pureness of padi.	.....	.....
	b. Uniformity of ripening.	.....	.....
	c. Freedom from empty grains.	.....	.....
	d. Quality of crop.	.....	.....
Total marks possible 100		.....	.....

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

FOURTH QUARTER 1931.

Rainfall.

In October, the rainfall generally was a little below normal. November showed a precipitation slightly above the average on the East and West coastal districts, while the inland figures were normal for the month. In December the general rainfall was above the average, particularly in the inland districts of Perak and Pahang, occasioning the flooding of the Perak and Pahang rivers: the rainfall along a strip of the Selangor—Negri Sembilan coast, however, was slightly below the average.

Prices.

The following tabulated summary indicates the prices paid to small-holders by local dealers, as compared with the average Singapore price for the month for standard sheet and price quoted in Singapore and Penang by large dealers for small holders' rubber at the end of the month.

All quotations are given in Straits dollars and cents at the price per picul (133½ lbs) for ease of comparison.

Table of Rubber Prices
4th Quarter 1931.

	Singapore Standard sheet Average	Singapore for small holder's rubber	Penang for small holder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Penang	Johore
	OCTOBER										
Smoked sheet.	11.75	12	9-12	7-11.50	9-12	7.50-12	7-12.25	7.50-12	9-10	8-13	8-12.25
Unsmoked sheet.		10	7-11	6-10	7-9.30	6.50-10	7-9	6.75-10.50	3-9	7-10.50	5-10.50
Scrap		2	5-6	3-5.50	2.50-5	2-6	3-5.50	2-6	4	3-6	2-6
	NOVEMBER										
Smoked sheet	11.68	9	9-12.25	9.40-11.40	10-11	9.50-11.20	9-12	8-12	9-10	8-12	6-10.80
Unsmoked sheet		7.50	7-10	8.50-11.15	8.50-10	7.50-10	7-9	7-10	8-9	6-10.80	5-9.75
Scrap		2	3-5	5-6.20	2-6	3-5.50	3-5.50	2-5.50	4-4.50	2.50-4	1.50-5.50
	DECEMBER										
Smoked sheet.	13.24	11.75	12.25-13.80	10-25-14	11-15	8-14.50	10-13.75	8-15	11-14	No returns received owing to floods	9-13.75
Unsmoked sheet.		10.50	9-13	9.50-11.75	8.70-12	7-13.50	7-11.75	7.75-13.50	9-13		8-12.50
Scrap		4	4-6	5-7	2-6	3-6.50	3-6.50	2-7	4-8		2-7

In comparing the above figures it must be realised that the quotation for Singapore standard sheet is the average price for the month, whereas other quotations give the range of prices during the month, and except in the case of Singapore and Penang, the range of prices over a number of buying centres. In some of these centres the price is regularly maintained at a higher level than others. For example in Perak for December the range of prices in dollars per picul for smoked sheet at the centres was as follows—

Taiping \$13 to \$14.50	Tapah \$12.50
Krian \$11.50	Kinta \$11.50
Selama \$10 to \$13	Tanjong Malim \$12
Kuala Kangsar \$11 to \$11.50	Bagan Datoh \$11.50
Lenggong \$8 to \$12	Teluk Anson \$12.

It will be noticed that the prices paid in several centres are higher than Singapore or Penang quotations for small-holder's rubber.

Tapping.

Report from Penang Island states that small holdings continue to go out of tapping and that many have now been abandoned. In no other case do the reports from the districts indicate any further cessation of tapping on holdings of a small area, which are either owner-tapped, or worked on a share system, other than the normal decrease of tapping in padi areas during the harvesting season.

On a number of Chinese and Chettiar owned holdings of a larger area employing hired labour, the area under tapping has been decreased, poor yielding portions being left to rest. There has been no noticeable alteration in the habitual tapping systems, fluctuations in market price do not appear to have affected the output.

The following table obtained from the bark consumption investigation figures shows the monthly average percentage of trees in tapping taken over lots of 100 consecutive trees per holding on 62 holdings over a period of 3 months.

Nationality of owner.	Average percentage of trees in tapping in each 100 trees.	
Malay	...	65
Chinese	...	69
Tamil	...	68
Javanese	...	65
Sumatran	...	61

In almost every case trees are left out of tapping only on account of low yielding and not because of an insufficiency of tappable bark.

The following figures have been given by the Bark Recorder showing the systems of tapping cuts in vogue on small holdings; these figures represent the average taken from 3 consecutive monthly measurement on lots of 100 consecutive trees or a total of 62 widely distributed holdings.

Table of Tapping Systems and Lengths of Cuts.

1 Average percentage of single cuts on each holding.	2 Average Length of each single cut.	3 Average percentage of Y cuts.	4 Average Length of each Y cut	5 Average percentage of 2 cuts on same panel.	6 Average Length of each cut.	7 Average percentage of cuts of different height on different panels.	8 Average No. of cuts.	9 Average Length of each cut.
Malay owned holdings (28 Holdings)								
72	$\frac{2}{3}p + \frac{2}{3}p$	14	$\frac{2}{3}p$	2	$\frac{2}{3}p + \frac{1}{3}p$	12	2	$\frac{2}{3}p + \frac{2}{3}p$
Chinese owned holdings (16 Holdings)								
94	$\frac{2}{3}p + \frac{2}{3}p$	2	$\frac{2}{3}p + \frac{1}{3}p$	1	$\frac{2}{3}p$	3	2	$\frac{2}{3}p$
Tamil owned holdings (8 Holdings)								
81	$\frac{2}{3}p + \frac{2}{3}p$	4	$\frac{2}{3}p + \frac{2}{3}p$	3	$\frac{2}{3}p + \frac{2}{3}p$	12	2	$\frac{2}{3}p + \frac{2}{3}p$
Javanese owned holdings (5 Holdings)								
48	$\frac{2}{3}p + \frac{2}{3}p$	51	$\frac{2}{3}p$	—	—	1	2	$\frac{2}{3}p + \frac{1}{3}p$
Sumatran owned holdings (5 Holdings)								
88	$\frac{2}{3}p + \frac{2}{3}p$	—	—	5	$\frac{2}{3}p + \frac{2}{3}p$	7	2	$\frac{2}{3}p + \frac{2}{3}p$

For the purpose of recording, the circumference of each tree is divided into 4 equal panels, each of which is in turn divided into 8 equal parts, thus in the above examples $\frac{8}{8}p$ is equivalent to $\frac{1}{4}$ of the circumference of the tree and $\frac{8}{8}p$ plus $\frac{2}{8}p$ signifies that the cut runs through a full panel and $\frac{1}{4}$ of the adjacent panel, i.e. approximately $\frac{1}{3}$ of the total circumference.

Bark Consumption.—The following figures have been compiled from results obtained from the bark consumption investigations over a period of 3 months on 62 holdings.

The average monthly bark consumption per tree, is expressed in vertical inches on a panel which is one quarter of the circumference of the tree in width.

Column A = figures taken on actual number of trees in tapping only.

Column B = bark consumption shown on 100 trees, including untapped trees.

Malay.		Chinese.		Tamil.		Javanese.		Sumatran.	
A	B	A	B	A	B	A	B	A	B
$3\frac{1}{2}$ in.	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.	$1\frac{1}{2}$ in.	$3\frac{1}{2}$ in.	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.	$1\frac{1}{2}$ in.	$3\frac{1}{2}$ in.	2 in.

Total average consumed on trees in tapping over all holdings = 3 inches.

Average number of days on which tapping is carried out at present = 18 days.

The following are the maximum and minimum monthly bark consumption in inches on the above holdings.

Malay.		Chinese.		Tamil.		Javanese.		Sumatran.	
A	B	A	B	A	B	A	B	A	B
Maximum 8½ in.	4½ in.	4½ in.	3½ in.	4½ in.	3½ in.	3½ in.	2½ in.	5½ in.	4 in.
Minimum 1½ in.	½ in.	1½ in.	½ in.	2½ in.	1½ in.	½ in.	½ in.	2½ in.	1½ in.

Minimum consumption in most cases is due rather to a limited number of tapping days per month than to care in the actual operation of tapping.

The distribution of nationality of owners of these 62 small holdings is as follows :—

Malay	...	28 holdings i.e. 45 per cent. of total number.
Chinese	...	16 holdings i.e. 26 per cent. of total number.
Tamil	...	8 holdings i.e. 13 per cent. of total number.
Javanese	...	5 holdings i.e. 8 per cent. of total number.
Sumatran	...	5 holdings i.e. 8 per cent. of total number.

Ratio of Excision to Renewal.—No reliable data are yet available on this subject; a system of measurement of bark renewal is in practice in connection with the bark consumption investigations, but no figure can be supplied until after a lapse of 12 months from the date of first measurements of depths taken on newly tapped bark.

Postponement or Acceleration of Bringing Young Rubber into Tapping.—In only one case has any tapping of immature trees been reported, that is in a Banjarese Settlement in the Dindings, where poverty is acute. Throughout the rest of the country the position with regard to acceleration or postponement of tapping of young rubber has not altered during the quarter.

Incidence of Disease and Soil Erosion.

Root Diseases.—General observations still incline to the opinion that root diseases are far less common on small holdings than on estates.

The Bark Recorder reports that from an above-soil examination of lots of 100 consecutive trees on 36 widely distributed holdings, only 22 cases of root diseases out of the total 3600 trees inspected were found as follows :—

12 cases *Ustulina zonata*, 10 cases *Ganoderma pseudoferreum*; making an average incidence of 0.6 per cent.

Mouldy Rot.—Apart from the seasonal increase of infection due to wet weather, the position with regard to mouldy rot remains unchanged since the last quarter's report.

Exposure.—This would not appear to be a very vital problem on small holdings; close planting, in some instances the planting of catch crops under young rubber, and the general practice of allowing the growth of weed, are all factors which minimise the loss of soil by erosion.

Budgrafting.

This is practically non-existent on small holdings. A few visits were, however, paid to the Rubber Research Institute's Experimental Station by Chinese for a demonstration of the standard procedure."

Grades of Rubber made.

There has been no noteworthy alteration in marketing methods since the report for the 3rd quarter, July—September. Small-holders in most districts continue to favour the sale of uncured rubber, more especially Malays who frequently sell rubber in a wet state, i.e. after hanging for not more than 24 hours, a practice which indicates an urgent need for ready cash. It cannot be said, however, that this habit has become very noticeably more common than during the preceding quarter. The preparation of "slab" rubber on a large scale is still principally confined to the Krian-Matang and Larut Districts of Perak, although there is a tendency in the Kuala Langat District of Selangor to increase the production of lump or "slab" rubber in preference to sheet. The range of prices per picul obtained for this form of rubber was \$5 in October, \$4.50 to \$6 in November and \$5 to \$6.50 in December.

The following table shows the relative percentage of the sale of smoked, unsmoked sheet "slab" and scrap, in districts where records have been made.

DISTRICT.	Percentage of smoked sheet	Percentage of unsmoked sheet	Percentage of slab	Percentage of scrap.
Krian	25	50	25	
Selama	70	20		10
Batu Kawan	No sale	74	26	
Bukit Gantang	No sale	53	28	19
Kuala Kangsar	30	45		25
Tapah	28	72		
Kuala Selangor	100	No sale	No sale	No sale
Klang	90	No sale	No sale	10
Kuala Langat	80	10	10	
Ulu Langat	72	12		16

Tendency to abandon Rubber Cultivation for alternatives.

The increasing activity displayed in the planting of food crops on rubber holding appears to be merely subsidiary, although in Kuala Lumpur and Ulu Langat Districts of Selangor a few small areas of poor-yielding rubber amounting to an approximate total of 20 acres, have been cut down and food crops have been planted instead.

New Planting.

No newly planted areas have been reported during this quarter.

Planting Distances.

Figures received in connection with the bark consumption investigations show the following average planting distances taken from observations on 36 widely distributed holdings together with the approximate average age.

Nationality of owner.	No. of holding observed	Average planting distance.	Maximum.	Minimum.	Average age of	
		feet.	feet	feet.	trees.	
Malay	...	15	13 x 13½	18 x 18	8 x 10	16 years
Chinese	...	9	16 x 16	20 x 20	12 x 12	18 years
Tamil	...	3	16 x 16	18 x 18	12 x 12	14 years
Javanese	...	4	13 x 13½	15 x 15	12 x 12	15 years
Sumatran	...	5	14 x 13½	15 x 15	15 x 15	15 years

The Agricultural Field Officer, Penang and Province Wellesley has furnished figures of average planting distances taken on 453 holdings on Penang Island, Province Wellesley and the Dindings. The minimum planting distance recorded is on a holding on Penang Island which is at 7 feet x 8 feet. There are only 9 holdings on which the planting distance is less than 10 feet x 10 feet: the maximum distance is 21 feet x 21 feet and only 12 holdings show a distance of 18 feet x 18 feet and over. There are two interesting cases of "avenue" planting recorded, on one of which the planting distance is 14 feet x 25 feet and on the other 16 feet x 23 feet; the approximate average distance overall is 13 feet x 14 feet.

Departmental.

FROM THE DISTRICTS.

The Weather.

The dry weather commenced somewhat earlier than usual, the first three weeks of the month being generally hot and dry, except in Kedah where the wet season continued until about the middle of the month. There were occasional strong North Easterly breezes in Selangor and Negri Sembilan; high winds were also experienced in several other parts of the country. During the last week of the month there were frequent showers in the central portion of the Peninsula.

Remarks on Crops.

Rubber.--Price quotations for small-holder's rubber have decreased slightly from those which prevailed during December, ranging in dollars per picul from 8—14 for smoked sheet, from 7—12.50 for unsmoked sheet and from 2—7 for scrap: the price for "slab" rubber in Northern Perak was from 5—6 dollars per picul. For comparison it may be stated that the range of prices in Penang for small-holder's rubber was from 11.20—13 for smoked sheet and from 8—9.60 for unsmoked sheet.

Dry weather during the month caused wintering to commence generally in most parts of the country. In Province Wellesley and Negri Sembilan, a number of small-holdings were left untapped while their owners were occupied with the padi harvest, this cause increased the untapped area in Negri Sembilan by 1200 acres, to a total of 8200 acres. Wintering was also responsible for the cessation of tapping on a number of other properties, more especially on those owned by Chettians. On the other hand, low yields due to wintering caused severe tapping in the Dindings and tapping by torchlight at 3 a.m. on Penang Island. In Singapore island tapping was recommenced on a number of holdings owing to the approach of the Chinese New Year.

Except in parts of Perak South and Selangor, where it was still troublesome, there was a considerable decrease in the prevalence of Mouldy Rot disease, caused by the drier weather.

Padi.—The padi harvest was completed in Selangor and was nearing completion in Negri Sembilan and Malacca. In all other areas it had been commenced, though the state of development of the crop varied considerably. On the whole, the harvest is earlier this season than it has been for several years. Crop prospects are good in Kedah and Malacca and in other centres better yields are being obtained than those of last year, except in Province Wellesley Central and South, Penang Island and the Dindings, where draught and pests have caused considerable damage. It is noteworthy that unusually high winds have caused "lodging" of the ripening crop in several localities. It is remarkable that in the mukims along the Perak river the padi, which was under water for a week, was not severely damaged by the floods unless it was already in flower or growing

in places where the subsiding water collected and remained stagnant. No reports have yet been received from Pahang. In Kedah and in Krian difficulty has been experienced in obtaining assistant labour to reap the crop. There has been a slight rise in the price of padi, which in Kedah, the Province and Krian, has ranged between 6 and 8 cents a gantang. Elsewhere prices have ranged from 8 to as much as 20 cents a gantang.

Tobacco.—There has been an extension of the area planted with this crop in Perak South and Selangor. In the latter State a Jaffna type appears suitable for planting on the peaty soils of Kuala Langat District. In the Settlement of Penang 96 piculs of cured leaf have been sold, the prices varying from \$10 to \$30 per picul; elsewhere the prices have ranged from \$30 to \$40 for cured leaf. In Perak South it is reported that the locally grown product is coming into competition with Siamese tobacco imported by the Chinese shopkeepers.

Fruit.—A good "off-season" crop of fruit, such as durian and mangosteen, was harvested in Province Wellesley and the Kuala Langat District of Selangor: the crop was also coming into the market in Perak North and the remaining Districts of Selangor. In Negri Sembilan, however, fruit had not yet appeared on the market, while in Singapore the crop was reported to be poor.

Foodstuffs and Vegetables.—It was observed that Malays in Penang Island were growing vegetables somewhat extensively on the bunds of padi fields. In the mukims along the Perak river vegetable gardens were washed away by floods, but maize is now being planted on the islands in the river and along the banks. In Malacca an increased tendency to plant food crops has been observed, although the increase in the amount produced is not yet very great. Some Chinese owners of padi land near the town are planting vegetables on their land during the "off-season".

Cover Crops.—A native cover-crop, identified as *Marremia* (*Ipomoea*) *eritfolia* is thriving well and proving useful under young rubber on an estate in Kedah: it has the advantage of not being damaged by the giant snail, which is abundant on the property.

Live Stock.—The export of live stock from Kedah increased considerably, owing in no small part to adverse rates of monetary exchange with Siam; as the State was overstocked this revival of the export trade was welcome.

Rat Control in Padi Fields.—Little or no damage caused by rats has occurred in Province Wellesley or Krian during the month. In Penang Island, however, where the work has recently been organized, severe damage occurred in some localities. Giant snails have been used as bait, a hole being drilled in the shell and sodium arsenite inserted; they are reported to be as effective for this purpose as dead grass hoppers.

Agricultural Stations and Padi Test Plots.

1. **KEDAH.** *Telok Chengai Rice Station and Padi Test Stations*.—The padi at the Rice Station matured under favourable weather conditions. Field characters

of pure lines of local varieties were checked and preliminary selections made. Rain and wind caused certain varieties to lodge, notably Siam 29 and Nachin 10, which also lodged at all the Test Plots where they were grown. At all the Stations observations were made on the incidence of stem-borers which were numerous at the Telok Chengai Rice Station and on Jitra Test Station although, as the attack occurred late in the season, the resulting damage was not serious.

PROVINCE WELLESLEY. *Glugor Padi Test Station.*—Much time was given to rat control, more especially by pumping calcium cyanide powder into rat holes in bunds, with satisfactory results. Damage by stem-borers was observed. Several of the padi strains flowered.

Bukit Merah Padi Test Station.—This Station was maintained in good condition, giving promise of a good crop. Several strains were commencing to ripen. Some of the plots of Siam 29 and Nachin 10 lodged owing to the weight of grain produced.

PERAK. (a) *Agricultural Stations Selama*—Further planting carried out during the month included pineapples, pepper, tapioca, groundnuts, Robusta and Liberian coffee and tea seedlings. Dry weather experienced after planting will render much supplying necessary when conditions again become favourable.

Kuala Kangsar.—Stumps of tea were planted out; work on the sيره garden was commenced. Other plantings included a plot of Rangoon tobacco, avocado pear and orange seedlings in nurseries and orange marcots in beds ready for sale.

(b) *Padi Stations and Test Plots. Talang.*—All strains of padi were flowering and had apparently suffered but little damage in the December flood.

Lenggong.—Harvest was about to commence at this Station where the Seraup strains were ripening. On several plots the Seraups lodged owing to wind and rain, but the Radin strains stood well.

Bruas.—The local Radin strain was being harvested, but ripening was uneven; Radin No. 7 was backward, having not yet reached the flowering stage, and showed poor growth. The Seraup strains, which had grown well, lodged owing to wind and rain.

Bukit Gantang.—Flowering was practically complete on the lower areas, but the padi was backward on high land where water difficulties have been experienced throughout the season. Rats continued to give trouble.

Kamunting.—The padi on this Plot was approaching maturity. Birds did appreciable damage in spite of efforts to protect the crop. Liberations of stem borer parasites were continued.

Selinsing.—The ripening crop presented a very promising appearance, having sustained no further damage from pests. During the month a well attended and successful demonstration to head-men was organised; the visitors were particularly impressed by the superiority of the crop on the cultivated plots.

SELANGOR. *Cheras Agricultural Station.*—The entrance gates, a temporary store and a manure shed were erected. Work was commenced on the preparation of the market garden area for planting and the market gardener's house was nearly finished. Coffee, tea, a number of local fruits trees, avocado pear, bananas,

pineapples, sugar cane, tuba root, tobacco and Guinea grass were planted.

Kajang Test Plot.—The padi harvest was completed, the yields recorded in gantang's per acre being, Nachin 27—320, Radin 2—120, Radin 13—265, while the average yield in the adjoining fields was 200. The low yields from the two Radin strains were due to damage by pests and birds and to unsatisfactory growing conditions.

Kuang Test Plot.—The harvest was completed during the month. Yields in gantang's per acre were, Radin 4—152, Seraup 48—161, Seraup 36—189, Nachin 27—221, Radin Siak—223, local padi—243, Radin 2—251, Radin 13—253, Nachin 10—334, Siam 29—441. The three late maturing varieties of padi first mentioned gave low yields owing to the depredations of birds and to heavy stem-borer attacks in the early part of the season. Nachin 27 and Radin Siak, being the first strains to ripen, suffered from the attacks of padi fly (*Leptocorisa* sp.) and birds.

NEGRI SEMBILAN. *Seremban Agricultural Station*—A further area of yams was harvested and a good crop of Salisbury White maize was reaped.

Rembau Agricultural Station—Marcots of chicku and rambutan, further cuttings of pepper and a plot of Bamarra ground-nuts were planted. *Crotalaria usaramoensis* was sown where low cover crops had not grown well.

Rembau Padi Test Plot.—Two plots received dressings of ammonium sulphate at the rate of 100 lbs per acre. A plot of F 756 was harvested and the one-hundred-day padi was transplanted and started well.

MALACCA. *Sungei Udang Agricultural Station*—Work was commenced on clean clearing the padi and root-crop areas. Banana suckers and pulasan marcots were planted. The buildings were nearing completion.

Pulau Gadong Padi Station.—Harvesting proceeded throughout the month and was practically completed at its close.

Alor Gajah Test Plot.—Harvesting was completed.

SINGAPORE. *Pineapple Experiment Station.*—The Acting Chief Agricultural Field Officer visited the Station on the 17th January to consider the revision of the manurial programme rendered necessary by the backward condition of the pineapple plants owing to the depleted soil.

DEPARTMENTAL NOTES.

Return to Duty of the Director of Agriculture.

Dr. H. A. Tempany, Director of Agriculture, S.S. and F.M.S., returned from leave of absence on 4th February, 1932.

School of Agriculture, Malaya.

The next school year at the School of Agriculture at Serdang will begin on or about 17th May, 1932. It is of interest to record that one private student from Sarawak has already been enrolled for the next three years' course and that places have been reserved in the school for one three years' student from British North Borneo and for two Pupils for the one year course from Brunei at the request of the respective Governments.

The interest taken in the school from abroad is encouraging.

Pigs at Serdang Stock Farm.

The stock farm at the Government Experimental Plantation, Serdang includes a total of 48 pigs. The health of the stock is good.

The carcase of a pigling suspected to be infected with worms was sent to the Veterinary Surgeon, Kuala Lumpur, for examination. The report stated that no parasites were discernible and the carcase was free from tuberculosis diseases. The heart, kidneys, spleen and digestive organs were normal, healthy and sound. There was, however, a pronounced cirrhosis of the liver. The Government Veterinary Surgeon added that these findings would tend to indicate the presence of irritant substances in the food. The lesion may, however, have been caused by frequent irritant medicines.

The Senior Agriculturist states that this particular young pig had not had any vermifuge or other medicines. It was about 3 months old. This individual out of 20 (two litters) was very emaciated and any irritant in the food would be expected to some extent to effect all the piglets.

There is the possibility that this pig, being weaker than the rest, was pushed away from the concentrated foods given, and relied for its maintenance on the grass that is fed daily.

In this connection, it is interesting to record that the Chemical Division has found traces of prussic acid in very young guinea grass (*Panicum maximum*). This might account for the irritant suggested in the report.

A few such cases occur in each litter and their condition has been attributed to internal parasites. Improvement has been observed in some pigs in the past after a dose of Santonin.

It is stated that the emaciation of one or two pigs per litter is fairly common throughout the country, the cause generally having been attributed to internal parasites.

Groundnut Cultivation in Malaya.

A firm of oil millers in Malaya has recently written to the Department to enquire whether groundnuts are grown in British Malaya, as the firm wishes if possible, to purchase local groundnuts for their mill.

This letter indicates that there is at hand a certain local market for groundnuts. The present annual net import of groundnuts is about 8,000 tons, valued at approximately one million dollars. In addition, about 13,000 tons of the oil are imported for local consumption, so that the net imports of nuts and oil is valued at about \$5,000,000 at present prices.

Planters who have groundnuts for disposal in quantity are invited to write to the Department, when they will be placed to touch with probable purchasers. (Ref. D.A 131/32).

Appointments.

Mr. G. D. P. Olds, B.Sc., Agricultural Field Officer, S.S., arrived from England and reported for duty on the 7th January

Mr. J. A. Baker, B.Sc., A.R.C.S., Agricultural Field Officer, F.M.S., arrived from England and reported for duty on the 7th January. He was seconded for duty in Johore on the 25th. January.

Leave.

Mr J. Lambourne, Assistant Agriculturist, returned from leave of absence on 7th January, 1932.

Mr. J H. Dennett, Assistant Chemist, returned from leave of absence on 21st January, 1932.

Mr. N. C. E. Miller, Assistant Entomologist, returned from leave of absence on 22nd January, 1932.

Statistical.

MARKET PRICES.

January, 1932.

Markets during the month have been dull and dragging, the volume of business passing in most articles being small owing to absence of demand from consuming markets.

Rubber.—The average buyers spot price in Singapore for rubber smoked sheet equal to London standard was 9.43 cents per lb., the average London price for the month being 3.05d. and New York Gold cents 4.49 per lb.

Palm Oil.—At the end of last year, £21 per ton was quoted C.I.F. Liverpool on a basis of 18 per cent. F.F.A. This price was maintained until the last week of January, when the price fell by 10 shillings. For the most part, the market has been reported steady, but ends quiet.

Copra.—Prices for January shew some improvement over the previous month. Sundried averaged \$5.73 per picul in Singapore, and Mixed \$5.20 per picul, as compared with \$5.71 and \$5.09 respectively for December, 1931. Copra cake was quoted at \$2.20 per picul throughout the month.

Coconut Oil.—The average wholesale export price in Singapore for coconut oil for the month of January was \$10 per picul. Business was rather dull and the increase of price was in sympathy with the increase in copra prices.

Gambier.—The market has declined for all grades during the month. Block gambier was quoted nominally at \$15 per picul at the beginning of the month and closed at \$13.20 the average price for January being \$14.30, as compared with \$13.20 for December, 1931. Cube No. 1 has declined from \$24 to \$21 per picul. The average price for January was \$22.40 per picul as compared with \$23 in December.

Rice.—The average declared trade value of rice, all sorts, per picul for 1931 was \$4.17, as compared with \$6.52, \$7.23 and \$7.06 in 1930, 1929 and 1928 respectively.

The average wholesale price of Siam No. 2 ordinary rice per picul in Singapore in December, 1931 was \$4.43, as compared with \$4.21 in November, 1931.

The retail market prices in cents per gantang of No. 2 Siam rice during December were Singapore 32, Penang 36 and Malacca 26.

Arecanuts.—Palambangs have dropped from \$4.15 to \$3.60 per picul, the average price for January being \$3.88 as against \$4.22 for December. Bila Whole has declined by 40 cents, the average price for the month being \$3.97 as compared with an average of \$4.30 in December. For other grades, the average prices in January were Split, \$4.65 to \$6.15; Sliced, \$9.15 to \$13.10; Red Whole, \$7.55 to \$8.75—all per picul, the price within each range depending upon quality. There are at present no stocks of Kelantan Splits.

Coffee.—There has been no demand for coffee. Average quotation in

January for Palambang coffee was \$17.75 as compared with the previous month's average of \$15.62 per picul. Java Robusta averaged from \$23.80 to \$24.80, the price within these limits depending upon quality.

Pineapples.—Quotations are easier. The London market is listless, but sellers are still disinclined to meet the sagging prices. The following are the average prices per case for January :—1½ lb. cubes, \$3.92; 1½ lb. sliced flat, \$3.80; 1½ lb. sliced tall, \$3.69 nominal as compared with \$3.90; \$3.50½ and \$3.61 respectively for December.

Tapioca.—Prices shew a slight downward movement. Average prices per picul in January were :—Flake, fair, \$3.20; Pearl, seed, \$4.45; Pearl, medium, \$4.70. Corresponding prices in December were :—\$3.33, \$4.50 and \$4.75.

Sago.—Dealers pressing sales on account of the approach of Chinese New Year caused a break in prices. Some recovery is recorded due to the demand from Japan and India. The following are the average prices for January :—Pearl, small, fair, \$4.42, Flour, Sarawak, fair \$2.72 per picul as compared with \$4.85 and \$3.20 for the previous month.

Nutmegs.—A neglected market. Average prices for January were :—110's, \$27.30 per picul; 80's, \$30.40 per picul.

Mace.—No business and general decline in prices. Siouw averaged \$57.40 and Amboina \$47.80 per picul in January.

Pepper.—Market without interest. Average prices per picul for January were :—Singapore Black \$23.50; Singapore White \$30.70, Muntok, White, \$31.70, as compared with \$23.80, \$32.20 and \$33.20 in December.

Cloves.—Prices for cloves have been nominal and unchanged throughout January at Zanzibar \$48 and Amboina \$50 per picul.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co. Ltd, Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133½ lbs.

The Dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.*

December, 1931.

Malaya.—Gross foreign imports of rice (including rice for re-export) during December, 1931, amounted to 53,377 tons, as compared with 83,560 tons for the same month last year. Of these imports, 46 per cent. were from Siam, 52.2 per cent. from Burma, 0.3 per cent. from French Indo-China and 1.5 per cent. from other countries.

Gross foreign imports of rice for the year 1931 were 691,110 tons, as compared with 800,444 tons in 1930, a fall of 13.7 per cent. Net imports were 516,832 tons as compared with 593,847 tons in 1930, a decrease of 13 per cent.

The total foreign exports of rice in December, 1931, were 17,515 tons, including 84 tons domestic production exported from Penang. Total foreign exports for the year were 174,278 tons as compared with 206,597 tons in 1930.

The padi reports indicate that work for the new season 1931—32 is in hand in all areas. In Perlis, five months' padi has already been cut and the main harvest will be in January—February.

For the season 1930—31 the total area of padi in Malaya was 708,000 acres, and production 260,000 tons of clean rice. This compares with 657,000 acres and 154,000 tons of rice for the season 1929—30.

India.—Total foreign exports of milled rice during January to October, 1931, were 1,806,000 tons, a decrease of 562,000 tons or 23.7 per cent. as compared with the corresponding period of 1930, and a decrease of 214,833 tons (10.6 per cent.) as compared with the average of the corresponding period for the past six years.

The Third Forecast of the Rice Crop in Burma for the season 1931—32 gives the area likely to mature as 12,090,300 acres, being 507,700 acres or 4 per cent. less than the final figures of last year.

The estimated outturn (states the Forecast) is 6,648,000 tons of padi which is 979,000 tons, or 12.8 per cent. less than the corresponding estimate of the previous season. The year's exportable surplus is estimated at 3,919,000 tons of rice and rice-products.

The following is an extract from Reuters' New Service dated 19.1.32. "London 18.1.32: The Government of Burma reports that the exportable surplus of rice is likely to be considerably less than was expected owing to the failure of late rains."

Siam.—Deliveries of padi at the Bangkok Mills for the year ending November 30, 1931, were 958,812 tons (approx.) an increase of 11.6 per cent. as com-

*The following is an abstract of the General Rice Summary for December, 1931, compiled from various sources by the Registrar-General of Statistics, S.S. and F.M.S.

pared with 1929—30, and a decrease of 18.8 per cent. as compared with the average of the past five years.

Exports of rice from Bangkok for the same period were 1,185,616 tons, an increase of 15.6 per cent. as compared with 1929—30, and a decrease of 10.9 per cent. as compared with the average of the previous five years.

According to the First Forecast of the 1931 Rice Crop (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the area planted in the Seven Inner Circles at the end of November amounted to 4,480,000 acres, being 140,000 acres (3 per cent.) less than the final figures of 1930. The area damaged is estimated at 880,000 acres. The yield is estimated at 2,140,000 tons of padi and after deducting an amount of 1,200,000 tons for consumption and seed purposes, and adding 300,000 tons carried over from last season's crop, the surplus available for export during the present season from the Seven Inner Circles is approximately 1,240,000 tons of padi, or 930,000 tons of rice.

In the Northern and North-Eastern Circles, it is reported that there will be little surplus available for export during the coming season. It is expected, however, that the crop will be sufficient to enable them to provide for their own needs.

In the Southern Circles, it is estimated that there will be a small deficit which it is expected will be met as usual by imports from Burma.

Netherlands East Indies—According to *Korte Berichten*, at the end of November, 1931, the area harvested amounted to 8,472,705 acres, a decrease of 140,868 (1.6 per cent.) as compared with 1930; the area damaged to 419,226 acres, an increase of 191,241 acres (83.9 per cent.) as compared with 1930; and the area standing to 1,817,319 acres, an increase of 129,700 acres (7.7 per cent.) as compared with the previous year; a total of 10,709,250 acres of rice-lands as compared with 10,529,177 acres last year, an increase of 1.7 per cent.

Java and Madura. *Korte Berichten* of December 24, 1931 states that the area of wet padi harvested in Java and Madura during the first eleven months of 1931 was 140,868 acres less than for the same period of 1930 and 194,250 acres more than the average of the same period for the years 1921/30. The area of dry padi harvested during the first eleven months of 1931 was 99,750 acres more than the average during the years 1921/30.

No statistics of area planted or harvested in the Outer Provinces are available.

French Indo-China.—Entries of padi at the port of Cholon for the year ending December 31, 1931, were 1,098,904 metric tons, a decrease of 59,800 tons or 5.2 per cent. as compared with 1930.

Exports of rice from Saigon for 1931 were 961,206 metric tons, a decrease of 97,205, or 9.2 per cent. as compared with 1930.

Information has been requested regarding prospects of the current season.

Ceylon.—Imports for 11 months ending November 30, 1931, were 399,538 tons, a decrease of 16,637 tons, or 3.9 per cent. as compared with 1930, and

a decrease of 51,079 tons, or 12.2 per cent. as compared with the average of the past five years.

Of the total imports in 1931, 16.5 per cent. were from British India, 74.3 per cent. from Burma, 0.3 per cent. from the Straits Settlements and 8.9 per cent. from other countries.

Europe.—To Europe, period January 1 to December 17, 1931, the shipments of rice from the East were 1,040,986 tons, as compared with 691,429 tons in 1930, or an increase of 50.5 per cent.

Of the total 1931 shipments, 57 per cent. were from Rangoon, 7 per cent. from Japan, 28.2 per cent. from Saigon, 5.5 per cent. from Siam, and 2.3 per cent. from Bengal.

To the Levant, period January 1 to November 13, 1931, the shipments of rice from the East amounted to 64,870 tons, an increase of 44,525 tons or 218.8 per cent. as compared with 1930.

During the period January 1 to November 12, 1931, the West Indies and America imported 145,999 tons of rice from the East, a decrease of 49,321 tons, or 25.3 per cent. as compared with the same period of 1930.

MALAYAN AGRICULTURAL EXPORTS, NOVEMBER, 1931.

PRODUCT	NET EXPORTS IN TONS				
	1930	Jan. 1— Oct. 31st 1930	Jan. 1— Oct. 31st 1931	November 1930	November 1931
Coconuts, fresh ..	10,475	9,054	7,093	672	1,416
Copra ..	102,014	81,818	79,580	13,168	11,419
Coconut Oil ..	9,475	8,005	8,129	702	906
Palm Oil ..	3,211	2,598	3,465	333	460
Palm kernels ..	485	405	554	36	90
Pineapples, canned	57,689	48,731	49,127	3,875	3,160
Tapioca ..	31,195	26,441	23,974	2,519	1,704
Arecanuts ..	23,254	20,089	16,086	1,249	1,440
Tuba root ..	55½	—	53	3*	15

* Excess of imports over exports

ACREAGES "OUT OF TAPPING" FOR THE MONTH OF DECEMBER, 1931.

(Estates of 100 Acres and over in F M S and S S)

TERRITORY	TAPPABLE AREA OUT OF TAPPING		TOTAL AREA UNTAPPED*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
	Acres	Acres	Acres
Perak ...	8,256	27,126	35,382
Selangor ..	11,798	37,440	49,238
Negri Sembilan .	14,903	20,958	35,861
Pahang ...	7,105	4,000	11,105
TOTAL F M S	42,062	89,524	131,586
Province Wellesley	3,283	8,247	11,530
Dindings	217	1,658	1,875
Malacca ..	4,760	16,264	21,024
Penang .	747	115	862
Singapore ...	10,247	5,735	15,982
TOTAL S S	19,254	32,019	51,273
GRAND TOTAL	61,316	121,543	182,859

* Areas rested due to the adoption of A B C and similar systems of tapping in F M S and S S during December (not included in the above figures) were — F M S 42,883 acres S S 13,146 acres, Total 56,029 acres

PRODUCTIVE RUBBER UNTAPPED IN THE UNFEDERATED MALAY STATES, DECEMBER, 1931

STATE	Productive Area Untapped (Acres)		Total area untapped (Acres)
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Johore	20,389	45,146	65,535
Kedah (a) ..	11,175	15,706	26,881
Kelantan	8,691	2,208	10,899
Prengganu (b) .	Nil	Nil	Nil
Perlis ...	308	156	464
Total U M S	40,563	63,216	103,779

(a) Registered companies only and are rendered quarterly, commencing with end June 1931

(b) Registered companies only

MALAYA RUBBER STATISTICS TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVEREX.
FOR THE MONTH OF DECEMBER, 1931, IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of 100 acres and over				Production by Estates of less than 100 acres and estimated 2				Imports				Exports including re-exports				Stocks at end of month			
	Dealers		Ports	Estates over and over	during the year		during the year		during the year		during the year		during the year		during the year		during the year		Ports	Dealers	Estates over and over			
	2	3			4	5	6	7	8	9	10	11	12	13	14	15	16							
1		
MALAY STATES.—																								
Federated Malay States	...	14,251	12,952	12,927	141,457	9,197	15,538	Nil	Nil	Nil	26	9,884	8,592	157,464	86,685	...	18,000	12,226	...	...	...	...
Johore	...	2,392	3,854	3,762	43,417	4,940	16,332	Nil	10	Nil	42	1,015	8,104	10,061	80,717	...	2,446	3,413	...	...	...	...
Kedah	...	514	2,464	2,533	26,374	1,706	13,471	Nil	Nil	Nil	Nil	799	3,811	7,612	32,678	...	448	2,159	...	...	...	...
Perlis	...	98	7	7	78	10	130	Nil	Nil	Nil	Nil	Nil	Nil	18	196	...	27	7	...	...	...	...
Kelantan	...	153	62	125	2,102	234	4,142	30	Nil	137	Nil	59	343	385	5,804	...	160	42	...	...	...	...
Trengganu	...	57	50	105	1,246	53	620	Nil	Nil	Nil	Nil	Nil	138	Nil	1,660	...	55	50	...	...	...	...
Total Malay States	...	17,392	19,389	18,879	211,664	16,147	37,077	30	10	137	68	11,737	21,056	175,028	207,940	...	21,136	17,897	...	...	...	...
SEMPANG																								
Malacca	...	3,243	1,421	1,570	15,729	(2)	(2)	Nil	Nil	Nil	Nil	2,184	...	...	51,287	...	5,658	1,264	...	...	...	...
Province Wellesley	...	102	596	513	5,663	2,448	25,346	Nil	21	669	20,848	5,178	Nil	71,332	Nil	...	102	535	...	...	...	...
Dindings	...	127	83	961	1,153	91	95	788	Nil	Nil	7,336	...	...	...	...	...	128	91	...	...	...	...
Penang	...	714	5,173	91	95	8,525	94,942	...	...	...	15,922	...	...	22,554	...	1,638	6,230	91	...	...	...	...
Singapore	...	3,431	32,727	302	182	2,126	...	...	...	...	102,278	35,448	23,984	343,664	Nil	3,069	38,603	287	...	...	...	...
Total Settlements	...	4,145	41,372	2,411	2,371	21,766	2,448	25,346	9,323	21,069	102,278	35,448	23,984	343,664	Nil	4,737	50,721	2,186	...	...	...	...
TOTAL MALAYA	...	4,145	58,765	21,800	21,249	239,437	18,588	195,422	9,353	21,079	102,411	35,516	35,741	21,026	510,590	207,940	4,737	71,857	20,683	

TABLE II
DEALERS' STOCKS, IN DRY TONS

Class of Rubber	Federated Malay States	S'pore	Penang	Province Wellesley	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	15,295	34,841	5,836	5,641	951	62,564
WET RUBBER	2,705	3,762	394	247	1,495	8,603
TOTAL	18,000	38,603	6,230	5,882	2,446	71,167

TABLE III
FOREIGN EXPORTS

Ports	For 1931	For 1930
Singapore	23,921	23,377
Penang	7,735	13,873
Port Swettenham	3,749	57,359
Malacca	336	4,486
MALAYA	35,741	99,595

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION

Area	For month	For 1931
Malay States	...	27,165
Straits Settlements	...	41,389
MALAYA	...	27,165

Local consumption of rubber during the year amounted to 1,521 tons.

- Notes**—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month + Consumption. Columns [12] + [14] + [17] + [19] + [21] = [23]—[4]—[5]—[9]—[10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the foreign exports of the Malay States from domestic production.
5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 20th January, 1932.

METEOROLOGICAL SUMMARY, MALAYA, DECEMBER, 1931.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT						EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE							
	Means of			Mean of A and B	Absolute Extremes			At 1 foot	At 4 feet	Total	Moist in a day		Number of days				Total	Daily Mean	Per cent			
	A.	B.	Min.		Max.	Min.	Max.				Lowest	Highest	in.	mm.	Precipitation, 0.1 in or more	Precipitation, 0.5 in or more				Thunder-storm	Fog morning or afternoon	Gale force 8 or more
	Max.	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.			hr.	hr.	%				
Railway Hill, Kuala Lumpur, Selangor	86.8	71.8	79.3	93	69	74	74	82.5	83.5	8.76	222.5	1.39	20	18	9	130.10	4.20	35				
Bukit Jeram, Selangor	86.0	72.0	79.0	90	70	76	74	82.7	84.5	11.99	304.6	1.78	22	18	1	167.75	5.41	45				
Sitiawan, Perak	87.3	72.7	80.0	91	70	77	75	82.5	83.6	15.25	387.4	4.26	24	20	6	155.80	5.03					
Kroh, Perak	84.0	69.0	76.5	88	65	72	71	78.4	80.7	11.94	303.3	3.33	22	13		174.60	5.63					
Temerloh, Pahang	83.4	71.7	77.5	89	70	73	74	81.3	84.0	16.00	406.4	3.82	26	21	9	103.05	3.32	28				
Kuala Lipis, Pahang	83.7	70.5	77.1	89	67	72	73	80.5	82.5	17.28	438.9	4.36	26	23	1	107.70	3.47	29				
Kuala Pahang, Pahang	82.2	74.0	78.1	86	72	74	76	78.7	80.7	51.14	1305.8	10.58	25	24	5	122.50	3.95	33				
Mount Faber, Singapore	84.2	73.3	78.7	89	72	76	76	79.7	81.6	11.93	303.0	2.75	23	19	1	103.40	3.34	27				
Butterworth, Province Wellesley	87.0	73.0	80.0	90	70	74	75	83.0	84.4	9.81	249.2	1.68	18	14	2	206.30	6.65					
Bukit China, Malacca	83.6	72.8	78.2	88	71	77	75	79.7	82.2	7.19	182.6	1.34	20	17	2	132.60	4.28	36				
Kluang, Johore	83.4	71.8	77.6	89	70	75	74	79.8	81.6	11.80	299.7	1.79	25	21	1	75.45	2.45	20				
Bukit Lalang, Mersing, Johore	81.4	72.3	76.9	85	70	75	74	79.0	80.1	30.86	783.8	6.86	26	21	6	93.45	3.01	25				
Alor Star, Kedah	83.3	71.8	79.5	90	68	78	74	82.9	84.8	16.23	412.2	2.76	13	13	2	214.35	6.91	58				
Kota Bahru, Kelantan	82.9	72.4	77.7	86	69	76	74	79.8	82.4	39.05	991.9	11.39	20	20		150.95	4.87	41				
Kuala Trengganu, Trengganu	82.9	72.7	77.8	85	68	79	75	79.6	80.8	17.95	455.9	6.75	27	22		151.15	4.88	41				
HILL STATIONS																						
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	68.3	58.4	63.3	74	55	61	60			22.27	565.7	3.02	27	23	2	89.30	2.88	24				
Cameron Highlands, Tanah Rata, Pahang 4750 ft	69.3	57.9	63.6	73	51	63	62	67.8	68.7	22.48	571.0	3.23	27	25	2	92.25	2.98	24				
Fraser's Hill, Pahang 4268 ft	68.4	60.9	64.7	75	56	63	63	69.3	70.6	16.26	413.0	2.22	29	26	1	67.70	2.18	18				

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

MARCH, 1932.

EDITORIAL

Encouragement of Crop Production.

In periods of abnormal trade conditions, such as exist at the present time, attention is directed to the possibility of a nation maintaining to a reasonable degree its standard of living by the production particularly of its own food requirements.

Whereas conditions in years of normal trade encourage nations to produce goods for which they are adapted in exchange for necessities of life from other countries this system entails considerable hardship during periods of trade depression.

We have past and present experience in Malaya of the hardship entailed on the peasantry by the lack of adequate local food production in periods when either imported food is restricted in quantity or dear, or when our main export products are unprofitable to the producer.

Already much attention has been given locally to the task of increasing the Malayan production of rice so that the country may be less reliant on external sources of supply. Steps have now been taken to improve matters in this direction, and the recently formed Department of Irrigation and Drainage constitutes a distinct advance in this direction.

While this problem engages our attention, it is fruitful to consider the efforts made to solve somewhat similar problems in other countries, and in this connection our attention is drawn to a revised edition of a statement issued by the Italian Ministry of Agriculture and Forests, General Direction of Agriculture on "The Wheat Campaign in Italy", initiated by the Italian Premier, His Excellency Benito Mussolini.

The subject is only indirectly related to the rice industry in Malaya, but is of interest both in relation to the development of agricultural policy and also as representing a large scale effort to increase the yield of a cereal crop.

The Italian campaign aims at increasing the production of wheat in Italy. Wheat is the staple food of Italians and the local demand is considered more likely to increase than otherwise.

The production of wheat in Italy up to 1925 only sufficed to meet about two-thirds of the total consumption, the remainder being imported. Moreover, compared with the countries of Northern Europe, the yields per hectare were low

although the total area cultivated was greater, being the second largest in Europe and the fifth largest of any country in the world.

It was considered that dependence of the country on foreign sources of supply was dangerous, particularly in view of Italy's strategic position; the campaign aims at lessening this and is regarded as a part of the Fascist agrarian policy for the Ruralisation of Italy.

The lines along which the campaign has been conceived aim at increasing the yield per hectare rather than extending the cultivated area. It is considered that, as the greater part of the cultivable land in Italy is already under cultivation it is not desirable to replace with wheat other crops which may be more profitable and which in any case are an essential part of the national economy, and that if yields could be raised, the area planted under wheat in 1924 should suffice to meet requirements.

To carry out the campaign, the National Wheat Committee was formed under the presidency of the Head of the Government, the Vice-President being the Minister of Agriculture and Forests. The number of members of the Committee is now eighteen of whom eleven are technical experts.

Under this National Committee, provincial commissions have been appointed, one for each of the 92 provinces in Italy.

The policy of the campaign comprises; firstly, general measures applicable to the whole community and secondly, local measures applicable to particular regions.

The general scope of the measures undertaken has been as follows:— research and investigation; instructional and propagandist; the provision of direct assistance to farmers; financial assistance and fiscal measures.

The provincial commissions indicate and define the essential lines of local technical and economic work and the policy to be adopted having regard to local conditions. They also apply and administer the approved provisions for carrying out such work.

The principal directions in which efforts have been undertaken include the strengthening of the local agricultural organisations by increasing staff and improving facilities; enlisting the active support of the movement by various agricultural bodies and by the establishment of experiment and demonstration plots on a large scale, about 35,000 having been established, combined with the extended organisation of research into all questions connected with the agricultural and economic aspects of the crop.

Efforts have also been directed to the organisation of propaganda on a large scale; the institution of wheat competitions; the reorganisation and extension of the provision of agricultural credit; assistance and encouragement in the use of better agricultural machinery and the extended use of fertilisers; and fiscal policy of the industry by raising the import duties on wheat. Concurrently, provision has been made for the raising and distribution on a large scale of improved and selected strains of seed.

In spite of adverse economic conditions, the wheat campaign has been sustained, the expenditure on agricultural services having been doubled since 1922, while on the wheat campaign a total sum of 225 million lira has been expended in the four years to 1930.

It seems too early to pronounce an opinion as to what extent the aims of the movement will ultimately be fulfilled, but as compared with the pre-war period 1909—13, the returns of wheat per hectare for the years 1926—30 show a distinct increase, the average yield per hectare for the whole of Italy being for the latter period 12.44 quintals as against 10.5 for the former, while there has been some increase in the area cultivated. In addition, there has been a marked decrease in the imports of wheat into Italy.

The parallel of wheat production in Italy and rice in Malaya is evident, and it is probable that other countries will find similar comparisons with their staple foodstuffs instructive. The Italian agricultural policy aims at awakening the agricultural conscience of the native and imparting a stimulus to the solution of the agricultural problem and the accomplishment of agricultural reforms, with the object of rendering the country not only self-sufficient agriculturally, but capable of developing its export trades. It is an experiment that has our sympathy and we shall follow its development with interest and profit.

Some attention has been directed of late to the possibility of the extended use of fertilisers in Malayan Agriculture.

Local Manuring. Speaking generally, it has been found that rubber grown on virgin land and with adequate precautions for soil retention should not require manuring except perhaps in exceptional cases and at comparatively long intervals.

The manuring of the more important of Malayan crops is not very general, but it is probable that as time goes on and the knowledge of the manurial requirements of such crops becomes more understood, scientific manuring will play a more important part in local agricultural practice.

An outline is given in an article in this number of the experiments devised and commenced in Malaya by the Department of Agriculture with the object of making available more exact knowledge concerning the manurial requirements of coconuts and oil palms.

It is pointed out that it is desirable that estates themselves should carry out experiments on manuring, but for this purpose the "lay-out" described is considered too intricate and it is recommended that in such cases larger plots should be demarcated.

The Department of Agriculture has made some enquiry regarding the local sources of fertiliser material, the result of which is stated in an article in this number. It will be seen that the local resources are extremely limited, consisting chiefly of bat guano which, outside Perlis, is available in such uncertain quantities that its export from the particular States in which it is found is generally prohibited. The only other source is fish refuse and bones. Both of them, being by-products of a local industry in one case and of local food supply in the other,

are necessarily restricted in quantity. It would seem that the future must largely depend for its fertilisers on imports and it therefore becomes doubly imperative that agricultural practice in Malaya should aim at conserving the inherent fertility of the soils. Wastage in the past has consisted chiefly of bad soil conservation and wastage of organic matter. Future policy should aim at retaining soil fertility by natural means rather than early recourse to artificial fertilisers.

**Observations on
Coconuts.**

The early history of many of the coconut estates in Malaya is not known or is shrouded in doubt. The chequered history of many precludes the possibility of judging today the ultimate effect on crops of cultural and other policies adopted in the past.

Fortunately, however, a few estates exist which possess complete histories of individual fields. The observations of a manager of such an estate are recorded in an article by Mr. A. C. Smith entitled "Observations on Coconut Crops" which will be found on another page. The author, a practical planter, concludes from the records of the estate of which he is manager, that on alluvial soil an estate should be self-supporting in its eighth year, by which time the crop should be about 5 piculs of copra per acre per annum. Maturity should be reached in the twelfth year from planting and profitable yields should thereafter be obtained for at least 30 years.

Original Articles.

EXPERIMENTS ON THE MANURING OF COCONUTS AND OIL PALMS *

One of the striking features of agriculture in Malaya is the remarkably small quantity of fertilisers, natural or artificial, employed for the major crops, rubber, coconuts, rice and oil palms. The manuring of rubber is receiving attention by the Rubber Research Institute, that of rice has been the subject of experiment by this department for a number of years. In this article it is proposed to give an account of the experiments in progress with coconuts and oil palms, leaving to a future date the statistical treatment of results and justification of the lay-out adopted.

There is increasing recognition of the difficulty of securing accurate and generally applicable information on the response of permanent crops to manuring or to cultivation, owing to the large variation inherent in such crops due in part to the use of unselected material. There are further difficulties in dealing with coconuts and oil palms due to the bulk and weight of the crops, to wide planting (50—55 trees per acre) and to the fact that an all the year round harvest greatly increases difficulties of supervision and recording. The factor of permanence which might appear to favour accuracy does not really do so since the relative yields of individual trees do not necessarily remain constant from year to year with sufficient exactness to enable any great reliance to be placed on preliminary records.

Coconuts.

Considering the lengthy period of coconut cultivation in the tropics, the absence of reliable experiments on the effects of manuring and cultivation is truly surprising; in addition, the few recorded experiments refer to coconuts growing on soils which are considerably lighter in texture than those on which the palms are commonly found in Malaya. It is doubtless due to this factor that, as a rule, manuring is conspicuously absent from local practice, our heavy coastal soils being much richer in plant nutrients than, for example, the light coconut soils of Ceylon.

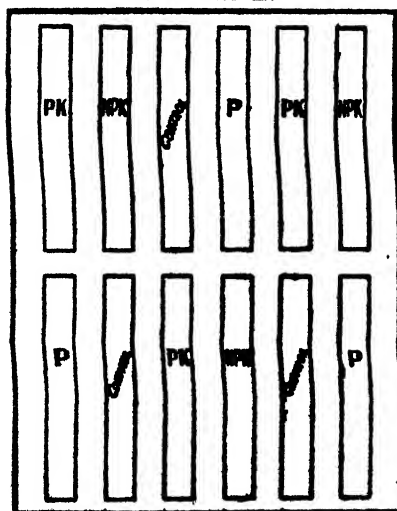
The Economic Botanist of this Department (Dr. H. W. Jack) has for some years carried out manurial experiments on one estate and publication of the results will be made in the near future; it was, however, felt that to obtain generally useful results more widely distributed experiments were necessary and the opportunity was taken of combining with manurial treatments investigations of the effect of a cover and of cultivation. The difficulties connected with recording have been mentioned. With the best good will it is not a fair charge on managers of estates to expect from them the careful supervision which is

* Compiled from Departmental Records.

DIAGRAM A.

NPK	LIME	LIME NPK	NPK
LIME NPK	NPK	NPK	LIME
LIME	LIME NPK	CONTROL	CONTROL
CONTROL	CONTROL	LIME	LIME NPK
Slashed.	Cultivated.	Clean.	Buried.

DIAGRAM B.



absolutely essential if results are to be of value; on the other hand, experimentation with large areas scattered about the country would involve an excessive strain on the personnel of the Department of Agriculture; the number of trees employed must, therefore, be kept down to the minimum requisite for the desired accuracy. Happily, recent advances in the application of statistical methods to agricultural experiments have provided methods of combining results from all of the treatments in any experiment and of analysing variation encountered into its component parts which enable the best use to be made of a limited number of trees.

After discussion by the Departmental Copra and Oil Palm Committee the following standardised lay-out was adopted on each of seven estates; four blocks were selected in different parts of the estate but on the same soil type and bearing trees of the same age. Each block was divided into 4 plots carrying 26 trees in two rows, while each plot was sub-divided into 4 sub-plots of 4 experimental trees separated by guard trees. The plots run parallel to drains which were dug where necessary. On each plot a different type of surface treatment was adopted. These were (1) grass or leguminous cover (whichever was growing on the areas selected) slashed every three months and allowed to lie on the surface, (2) grass or cover turned in to a depth of 7 inches every six months, (3) clean weeded, (4) clean weeded and cultivated to a depth of 7 inches yearly. Each treatment is thus repeated 4 times and is tested on 64 trees.

There are three manurial treatments and one control on the 4 sub-plots on each plot, namely complete fertiliser, lime plus complete fertiliser and lime alone. Each treatment is therefore repeated 16 times and on 64 trees. There is also the possibility of testing the effect of cultivation on manurial treatments and *vice versa*. Diagram A shows the lay-out of one block.

The complete fertiliser employed is made up as follows:—

Whale Guano Compound	...	2½ lbs. per tree
Steamed Bone Meal	...	4 lbs. per tree
Muriate of Potash	...	1½ lbs. per tree.

This mixture supplies Nitrogen (N) 12, (Phosphoric acid) P_2O_5 44, Potash (K_2O) 36 lbs. per acre.

Lime is supplied at the rate of 10 piculs (approx. 12 cwt.) per acre. Applications are made once a year, the manures being broadcasted.

Blocks are demarcated by wire fences and the trees of sub-plots are marked by means of different colour paints.

Demarcations and applications of manures are made by an Assistant Agriculturist and records of nuts are made by a Malay Officer of the Agricultural Division whose work is checked by surprise visits from Agricultural Field Officers.

The plots are harvested monthly by coolies who are trained to the work, all nuts approaching ripeness being picked, therefore there is practically no nut-fall between each picking. The error likely to occur if nuts were allowed to fall and roll into adjoining plots is thus avoided.

The harvesting coolies work under the supervision of the Malay Officer, who records the yields. Two coolies with knives on long bamboo poles are employed to pick the nuts and two coolies, one watching each of the pickers, to collect the nuts into heaps in the plots from which they are picked. The Malay Officer then records the number of nuts in a Field Book provided for the purpose, a separate account of bad and damaged nuts being kept.

The standardised experiments have been laid out with the cordial co-operation of Agents and Managers on estates distributed as follows:—

Estate	Locality	Age of Palms	Type of Soil	Date of 1st Application of Manures.	
A	Banting	21 yrs.	Alluvial Clay	Lime applied	11.7.30
			Loam	Manure "	31.7.30
B	Province Well-	Unknown	Sandy soil over	Lime "	5.1.31
	esley North	very old	white silt	Manure "	9.2.31
C	Province Well-	20 yrs.	Heavy clay	Lime "	4.3.31
	esley South			Manure "	24.3.31
D	Krian District	20 yrs.	Friable clay	Lime "	6.1.31
			Loam	Manure "	20.2.31
E	Bagan Datoh	20 yrs.	Heavy clay	Lime "	8.1.31
				Manure "	12.2.31
F	Sabak Bernam	17 yrs.	Very heavy clay	Lime "	9.1.31
				Manure "	13.2.31
G	Sepang	10—11	Peat overlying	Lime "	26.1.31
		years.	heavy clay	Manure "	23.2.31

Yield records are at present taken only of numbers of nuts, and as anticipated, in view of the long maturation period of the nuts no effects of cultural or manurial treatment have yet been found. On Estate B with the lightest and poorest soil and trees there is improvement in appearance and in numbers of young nuts carried on the trees.

Statistical treatment of the results from estates of the first year's manuring has shown that increases of 10 to 15 per cent. over controls for manurial treatment and of 15 to 22 per cent. for cultural treatment would be "significant" and that soil variation is small in comparison with variation from tree to tree.

As the experiment progresses it will be necessary to devise some practical means of recording the possible effect of copra per nut and this difficult question is receiving attention. The obvious solution of drying the nuts from each sub-plot separately would throw an undue strain on the management and might, as a result of mixing in the kiln, lead to erroneous results.

There are three obvious criticisms which may be made of the experiments described—

- (1) That only one manurial mixture is under observation.
- (2) That leguminous covers are only being tested on two estates and that grass is frequently said to have a toxic effect.

- (3) That the very important question of manuring of young coconuts is left untouched.

The answers to these criticisms are—

- (1) Staff and time are limited and it was therefore decided that a complete mixture should first be tried in order to ascertain whether on the generally heavy coastal soils of Malaya any response is obtained from manuring. If a response is found, subsequent various less complete mixtures or simple manures will be tried.
- (2) Limitation of staff and time again rendered it desirable to concentrate on the cover for the present growing on the estates.
- (3) It had been decided to carry out experiments on manuring of young coconuts on the contemplated extension at Klang Coconut Experimental Station. Unfortunately, the present need for economy has led to the postponement of this extension and of the contemplated experiments.

Oil Palms.

Unlike coconuts, oil palms are found in Malaya chiefly on inland soils which are frequently poor in nutrients, and in view of the considerable demands made by the crop, response to manuring is more likely to be attained than is the case with coconuts.

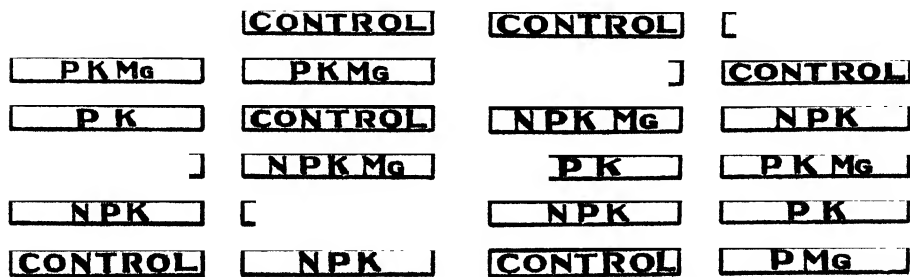
Unfortunately, owing to the necessity of weekly instead of monthly records, experiments are still more difficult to arrange. In addition, variability is nearly twice as great as that found in coconuts.

Three lots of manurial experiments have been laid out as follows:—

- (1) Experimental Plantation, Serdang, on palms 8 years old on a quartzite valley soil.
- (2) Estate A On palms 7½ to 8 years of age quartzite hillside soil.
- (3) Estate B On palms 9 years of age on (a) poor sandy, (b) organic soil.

Manures were first applied to the Serdang plots on 30th August, 1930 and to Estates A and B on 18th and 21st July, 1930, respectively. Preliminary records were made for one and a half years.

DIAGRAM C.



Block A.

Block B.

DIAGRAM D.

PK	CONTROL
P Mg	PK Mg
PK	CONTROL
P	NPK Mg
CONTROL	P
NPK	NPK

Block A.

CONTROL	P
P	CONTROL
NPK Mg	NPK
PK	PK Mg
NPK	PK
CONTROL	P Mg

Block C.

P	PK
NPK Mg	CONTROL
PK Mg	P
LIME	PK
NPK	P Mg
CONTROL	NPK
P Mg	NPK Mg
LIME	CONTROL
NPK	P
CONTROL	PK Mg
PK	CONTROL

Block E.

The treatments and lay-out at Serdang are as follows—

Twelve plots of 10 palms each are laid out in one block as per diagram B (which has already been published in the Guide to the Experimental Plantation, Serdang, facing p. 28).

The manurial treatments are in triplicate as follows :—

3 plots Nitrogen, Phosphate and Potash

3 plots Phosphate and Potash

3 plots Phosphate

3 plots Controls (untreated).

The method of application is the same as described for the experimental plots on Estates A and B.

The lay-out on Estates A and B is shown in diagrams C and D, plots consist of 10 trees each with guard rows.

The treatments are as follows :—

Sulphate of Ammonia (20 per cent.) at the rate of 1 lb. per palm.

Supherphosphate (18/20 per cent. P_2O_5) at the rate of 3 lbs. per palm.

Sulphate of Potash (50 per cent. K_2O) at the rate of 1 lb. per palm.

Sulphate of Magnesia (16 per cent. MgO) at the rate of $1\frac{1}{2}$ lbs. per palm.

These were supplied in various combinations every six months supplying Nitrogen, Phosphate, Potash and Magnesium respectively as indicated on the plan showing the lay-out.

Before the application of the manure the plots were dug over leaving the soil rough.

The various mixtures were prepared and put into suitable sized bags to ensure even distribution of the manures over the plots. The mixtures were spread by hand, the application extending to the guard rows on either side of the plots. The manures were then stirred into the soil by coolies breaking down the rough surface soil.

On Estate B blocks B and D two plots were treated with freshly burnt lime at the rate of 10 piculs per acre (approx. 12 cwt. per acre).

On Estate A the experiment plots are laid out on the gentle slopes of hill-sides and each palm has had a silt pit dug on its lower side, the soil from this source being used to make a platform round each palm. On this estate, Blocks A and B are given the same treatment as A and C respectively on Estate B except that in Block A on Estate A owing to an error when making the first application the control plot 9 has changed places with NPK plot 12.

For 1932 as a result of pot culture experiments made in another connection the phosphatic manure has been changed to basic slag supplying the same quantity of phosphorus.

Examination of the preliminary yield records show that as in coconuts, soil variation is small compared with tree variation and that increases of 20—30 per cent. over the control would be necessary for significance. This figure, although high, represents approximately the increase necessary to repay manuring with a complete mixture. It should be realised that should the experiments proceed

according to plan the increase necessary for significance will become smaller as the experiment proceeds.

During 1932 a further series of simple experiments will be started at Serdang on nine year old palms growing on high level quartzite soils in Block 5D as follows :—

The whole area is to be divided into four equal plots and the scheme of manuring is to be as follows :—

One plot Rock Phosphate 23 per cent. P_2O_5	...	6 lbs. per palm
Kainit (double) 20 per cent. K_2O	...	4 " " "
		—
Total	...	10 " " "
		—
One plot Basic Slag 16 per cent. P_2O_5	...	8 lbs. per palm
Kainit (double) 20 per cent. K_2O	...	4 " " "
		—
Total	...	12 " " "
		—

Two plots controls. (untreated)

The manures will be applied yearly to alternate rows of palms so that the whole area in the treated plots will receive a dressing of manure every two years.

Yield records of all these palms have been taken since 1926.

Experimentations on Plantations.

It is probable and desirable that those responsible for the direction of estates will wish to experiment for themselves especially if positive results or indications of positive results are obtained from the experiments here described. It is not considered that a lay-out with a large number of small plots is suited to estate conditions and unless a special worker can be detailed, is likely to prove too complicated.

There are definite statistical and other advantages in a number of small plots, but owing to the relatively small importance of soil variations quite good results can be expected from a smaller number of larger plots say of one acre each. It is suggested that three one-acre plots per treatment would give significant increases of 15—20 per cent. for coconuts and of 20—30 per cent. for oil palms. It would be advisable to take preliminary yields for one year of a number of adjacent one-acre plots and to select those giving most nearly equal yields.

Summary.

A description is given of Departmental experiments in progress on coconuts and oil palms and suggestions are made for simple experiments suitable for estates

LOCAL FERTILISERS AND THEIR USES.

Compiled from information supplied by the Field Branch of the Department of Agriculture.

Information on the subject of local fertiliser materials, their preparation, sale and present uses has hitherto been scattered. The following article deals with the more important of such products and may lead to a true appreciation of their usefulness.

Phosphates of Lime.

It must not be forgotten that Christmas Island is part of Malaya and is the centre of an important trade in the rock phosphates that are mined in that Island. These phosphates of lime are exported and are principally employed in the manufacture of superphosphate. The export in 1930 was nearly 120,000 tons, valued at over \$2,000,000. This material is exported direct, mostly to Japan and Australia and is therefore only of passing interest in this place.

Guano.

In several parts of Malaya, notably in Perlis, near Ipoh in Perak and near Kuala Lumpur, bat guano deposits occur in caves in limestone hills. The largest deposits which are worked are situated in Perlis, but considerable quantities are obtained in the Districts of Kota Star, Kubang Pasu, Baling and Langkawi in the State of Kedah, although the available supply in that State is limited in quantity.

The Perlis deposits have been used by the local padi planters and others for many years. The caves have been exploited commercially from time to time, and a trade still exists in this product.

Perlis guano is not only frequently used in that State, but is exported. It is on sale in Kedah and in most Districts of Province Wellesley and Penang. The usual price paid by padi planters in the Province is 30 cents for 4 gantangs.

In the case of the Kedah supplies, the Government collects a royalty of 5 cents per picul from dealers, but Malay padi planters are allowed to take supplies for their own irrigated padi lands free of charge. It is, therefore, not possible to ascertain the quantity of guano collected and used each year. The export of guano from Kedah is prohibited.

The prices charged by dealers for different grades from Kota Star and Kubang Pasu at the present time are:—

Grade I, used for dipping purposes \$6 for 400 gantangs.

Grade II for broadcasting \$3 to \$5 for 400 gantangs.

Grade III for broadcasting \$2 to \$4 for 400 gantangs.

The weight per gantang varies from 7 lbs. to 9 lbs.

The Balang guano is sold for 15 cents per picul.

Guano from the caves of Kedah and Perlis varies considerably in physical

and chemical characters, even when obtained from one cave. Its colour ranges from dark chocolate to light brown. The rough classification stated above is based on odour, colour and feel.

As a rule, higher prices are charged for dark-coloured grades, which are probably newer deposits and contain a higher percentage of nitrogen than the lighter-coloured grades.

There was until recently an import of guano to Penang from Siam. This trade has now ceased as the Siam Government has forbidden its export.

There is now a small export trade in guano from Malaya. The net export in 1930 amounted to 584 tons valued at \$44,465.

Guano in Padi Cultivation.

Guano is the manure chiefly used in padi cultivation, especially in Kedah and Perlis, and to a less extent in Province Wellesley. Malay cultivators have two methods of using this fertiliser, *viz*: a dipping method and a broadcasting method.

Dipping Method.—About 44 days after sowing the padi seed in nurseries the young plants are pulled up by hand and the earth adhering to their roots is removed by striking sharply the bases of the seedlings against the side of an uplifted foot. The plants are then tied together in bundles and allowed to drain. These operations are usually performed in the morning so that the plants can be partially dried, and made ready for dipping in the manure in the afternoon of the same day.

Prior to pulling up the seedlings a small hole is dug in the ground in a dry place near to the nursery and in this is placed a supply of guano. A dark coloured guano which adheres well to the roots when wet is preferred. The guano would probably contain 17 to 25 per cent., phosphoric acid, but very little nitrogen. Water is mixed with the guano in sufficient quantity to make a soft paste, in this the bundles of plants are dipped. As each bundle is immersed in the paste it is sharply twisted and turned so that the roots and lower part of the stem of each plant may receive a thin coating of the manure.

After being dipped, the bundles are stacked in large heaps in a shady place, with all the roots facing one way, and covered with straw-mats, or grass. The heaps are not disturbed for two nights and during this period a number of adventitious roots are pushed out from the short, thick stem of the crown just above the root-zone. The first formed, or original roots, are nearly all destroyed in the uprooting operation so that it is these new roots, which after 2 nights only in the heaps may measure up to $\frac{1}{2}$ inch long and are thickly covered with root-hairs, that are able to take up any plant food supplied by the manure immediately after planting.

After remaining in heaps for the period indicated, the bundles are transported to the field. Before planting, the leaves are pruned back severely to reduce transpiration, but as a result of the very severe injury to the roots most of the outer leaves become dry and decay and the inner younger ones only con-

tinue to develop. A few days after transplanting, however, the short submerged stem lengthens considerably to a point just below the level of the soil. The length of this extension of the stem depends largely on the depth of planting, but it is usually 2 to 3 inches long. The plant then forms a new and larger crown with a mass of roots and rootlets and it is from this new crown that most of the subsequent development of the plant proceeds. The original root-system is, therefore, of secondary importance after the development of the second crown which, as has been shown, is formed as a result of the transplanting operation. It has been thought necessary to describe briefly here the young wet-padi plant in order to show that under local conditions the first-formed roots to which manure is applied take little part in the absorption of food after the plant has been removed from the nursery.

Whilst the object of the direct application of the guano is to enable the padi plant to obtain quickly and readily small supplies of phosphoric acid, it is doubtful whether in many cases the results obtained are worth while, even considering the small cost of the manure and labour, because the quality of the manure varies so much. Again, only small quantities are applied by this method. At the Telok Chengai Station, for example, where 35 bundles of plants were sufficient to plant one relong ($\frac{1}{3}$ acre), the amount of guano used was about 10 gantangs, say 80 lbs. containing by analysis 17 per cent., phosphoric acid, that is approximately 14 lbs. of phosphoric acid, only, per relong. The cost of the manure was 5 cents per gantang or 50 cents per relong.

The Broadcasting Method.—This consists of broadcasting the guano before, or soon after, planting at the rate of 80 to 100 gantangs (640—800 lbs.) per relong. The dressing is applied once in 3 years. The lighter-coloured guanos are usually selected for this purpose, and like those used for dipping purposes, their values, based on the manurial constituents they contain, are not known, so that the results obtained may, or may not, be satisfactory. The cost of the manure and labour is about \$5.40 per relong, or \$1.80 per annum. On suitable soils the increased yields due to manuring with a good grade of manure are said to be about 80 gantangs of padi the first year, 60 gantangs the second and 30 gantangs the third year, or a total of 170 gantangs, which valued at 7 cents per gantang, equals \$11.90 or a total profit of \$6.50 per relong spread over a period of three seasons.

The manurial experiments with guano of known composition now in progress at the Telok Chengai Experiment Station will, it is hoped, supply useful information as to the value of the local guano as a manure for wet padi when used either for dipping or broadcasting purposes. Even with such information available, the difficulty of evaluating the different grades, based on the amount of available plant food they contain, will still remain unless arrangements can be made for systematic analyses of the supplies sold to padi planters and others.

Dried Fish and Prawn Waste.

The trade in fish and prawn waste to be used as a fertiliser is of some im-

portance, especially in Province Wellesley and Penang.

The official figures compiled by the Trade and Customs Department shew that in 1930, the import of "Bones and Fish for Manure" amounted to 5,728 tons, valued at \$323,989. The figures for years previous to 1930 referred to "Bones for Manure", no mention being made of fish for this purpose. The export of bones was then about 500 tons per annum, so that it would seem that Malaya, in addition to producing fish manure, also imports this commodity to the extent of about 5,000 tons annually.

The preparation of dried fish and prawn waste is fairly extensively carried out in most districts of Province Wellesley and Penang on account of the nearness to the sea and comparatively large fishing population.

The method of preparation in the various Districts is as follows:—

Prawns are brought in to Penang Island by the fishermen and boiled for about an hour. Salt is then added at the rate of about 5 kati* to one picul of prawns (5 per cent.). After mixing, the product is sun-dried. On the completion of drying, it is placed in a bag and beaten on a mat for about 10 minutes. It is then sifted, the prawns that remain on the sieve being used for edible purposes, while the siftings are collected and sold as food for ducks or as a fertiliser.

From one picul of prawns treated, about 30 kati of dust and waste are obtained. The waste is sold for about \$2.50 per picul to local spice or fruit growers, or to dealers in Georgetown.

The chief centres of the industry are at Kuala Jalan Bharu, Kuala Sungai Pinang, Pasir Panjang, Pantai Acheh and Gertak Sanggol.

In the North District of Province Wellesley, the small fishes brought in by local fishermen are separated from those of marketable size and are placed in tubs with a quantity of salt, where they remain for 2 or 3 days after which they are sun-dried. This dried fish waste is sold for \$2 per picul, but is only used in small quantities as a fertiliser, the greater part being used as a pig food.

No prawn or fish waste is made in the Central District of Province Wellesley, but prawn waste is imported from Kuala Kurau, Perak, and is extensively used by Chinese market gardeners who pay \$3 per picul for dried fish and \$3.50 per picul for prawn waste.

In the South District of Province Wellesley, the unsold fish and prawns from local markets which are unfit for salting or feeding to pigs, are sold to market gardeners at 1 or 2 cents per kati. The gardener places this material in a tub, seals it up with mud and allows it to ferment for three weeks. When well decomposed it is used as a fertiliser.

In the Dindings, prawns, when plentiful, are boiled with a small quantity of salt, dried for 1 or 2 days and sold to water-melon growers at 4-5 cents per kati.

Prawn and fish waste is prepared in other parts of the country generally

* 1 picul = 100 kati = 133½ lbs.

to utilise the unwanted fish when the market is overstocked. Such material is used as a pig and poultry food if sufficiently good, otherwise it commands a ready sale as a fertiliser.

Bones.

The Malayan trade results in a small net export of bones, but in addition, the use of bones as a fertiliser is appreciated both by the Chinese and Malays, the former in connection with vegetable and fruit growing, the latter in padi cultivation.

In Singapore, bones from slaughter houses are generally purchased by hawkers for the preparation of soups. A small proportion of the bones so treated are crushed and used as a fertiliser.

It is recorded that bones from the slaughter houses of the North District of Province Wellesley are accumulated and sold, mostly to Malays from Malacca, at rates varying from \$1 to \$1.80 per picul. In the Central District, the uncrushed and burnt bones are sold at the rate of 80 cents per picul for uncrushed bones and \$1 per picul for burnt bones. In Malacca, the bones are classified by dealers into two groups i.e. large and small, the former commanding a somewhat higher price. Doubtless, bones from slaughter houses in other centres are similarly disposed of, and find ready purchasers.

The most consistent use of bones as a fertiliser in Malaya is found in Malacca, where it has long been the practice amongst Malays to employ this fertiliser, by a somewhat unusual method, in the cultivation of padi.

The Malays crush and burn the bones and then mix the ashes with water and soil. The padi seedlings, which are removed from the nursery when they are about 40 days, are steeped in this bone ash mixture for a day and night and are then transplanted.

Farmyard Manure.

The manure from the various dairies in the country, generally owned by Indians, is utilised in fruit growing and more generally in flower gardens. The supply is of little importance from an agricultural point of view.

It must not be forgotten that the Chinese market gardeners, scattered around the towns of any importance in Malaya are important local food providers. Their system of agriculture is intensive and the success of their enterprise therefore largely depends upon manuring. Many of them are pig breeders in addition and utilise the manure from the sties.

Conclusions.

From the foregoing account, it will be seen that, with the possible exception of Perlis guano, there are no large natural resources of fertilisers in Malaya.

Agriculture in Malaya has made use of the supply of natural fertilisers at hand, and it is evidence of the economic use of all fertilising material produced in the country.

OBSERVATIONS ON COCONUT CROPS.

BY

A. C. SMITH.

The primary object in analysing the yields from several adjacent blocks of mature coconuts was to determine if certain blocks of young palms were yielding returns commensurate with their age in comparison with the old heavy cropping areas at the same period after planting. Several interesting points were brought out which appeared worthy of record.

The soil in the main consists of well-drained sticky blue grey alluvial clay and is typical of most estates in the Lower Perak District. The palms throughout are planted 30 feet x 30 feet square (48 per acre) and water transport of the crop is the rule.

Accurate crop records from the various blocks have been maintained since first bearing, and as planting was commenced late in 1899 the period covered is 30 years which justifies one in forming fairly definite conclusions.

Cropping Capacities from Heavy Alluvial Soils.

In most countries where coconuts are grown on a large scale, the average soils are lighter in texture than those which support practically all the large commercial coconut areas in Malaya, whereas Sampson* is quite definite in his opinion that heavy soils are not generally suitable for the successful cultivation of the coconut. Nevertheless, our heavy alluvial soils, with good artificial drainage, have yielded very profitable crops, as will be observed from the diagram in which mean and annual yields are shown graphically for the several blocks. Blocks A to F, inclusive, totalling 1592 acres, produced in the eighth year an average of just over 1,200 nuts per acre or nearly 5 piculs of copra, which with normal prices should cover all expenditure. Block A of 103 acres, planted in 1900, has produced from its tenth year an average of 3,630 nuts per acre to date (twenty years). Similarly Block B, 294 acres, planted in 1901, has yielded annually from its tenth year 3,540 nuts per acre. Almost equally heavy crops have been harvested annually from the remaining blocks of which yields are portrayed in the diagram. Since 1913, the combined area (608 acres) of the three blocks A, B and C, has produced an average annual crop of 3,500 nuts per acre, equivalent to 14 piculs copra per acre (1 picul = 133½ lbs.), since 250 nuts may be taken as the average number required per picul. This is certainly a satisfactory achievement for any soil and compares very favourably with the best crop figures quoted by other countries. Yields have shown a definite tendency to decrease during the past four years. It may be that the soil is becoming exhausted and requires some form of stimulation, but crops are still extremely good and profitable. The diminution may also possibly be due only to the unusually

* Sampson, "The Coconut Palm". This conflict of Sampson's opinion and the experience in Malaya was pointed out by Belgrave in an article on "Coconuts on Heavy Soil", published in this Journal in June 1931. (Ed. M.A.J.).

prolonged dry seasons which have been experienced in this country during the past few years. Furthermore, the enormous crops of over 4,000 nuts per acre, which have been harvested in some years from the blocks portrayed, indicate that our heavy alluvial soils have wonderful productive powers when seasonal conditions are favourable.

How long our low-lying soils will be able to support these heavy crops is open to conjecture, but there are indications that where a high water-table is unavoidable it is highly probable that the profitable life of the palms will be restricted proportionately. The diagram shows that profitable crops have already been taken for twenty years from the older blocks, and though these areas may be past their prime, they certainly hold out prospects of remunerative crops for many years, (under normal price conditions) particularly if, as in other coconut producing countries, reasonable attention is paid to maintaining soil fertility.

The "Transitional" Stage in Production.

It has been shown by Jack* that on flat alluvial soils in this country, young palms of about 10 to 12 year old, after they have been yielding well for two or three years, experience a setback, or at least stagnate for a year or two before again producing good crops. Possibly this is an environmental effect resulting from a high water table, or possibly it marks the exhaustion of the nutriment in the top soil. The effect of the former might be that on the root system reaching water, natural development is temporarily arrested, causing a shock which retards growth until the palm has adjusted itself to the new conditions. The habit is not however, confined to low-lying areas, but has been observed in areas which maintain a deep water table—four feet or more—so that it is more probably a growth character marking the period between immaturity and full maturity. The diagram shows that this so called "transitional" period occurs approximately at the time when production is approaching its average, or in other words when palm yields have attained to within the limits of seasonal variation from the normal or mature yielding rate and are first affected by climatic factors.

Thus in Block A, planted 1900, this occurs in the eleventh year, when there was a definite setback, probably emphasised by climatic factors, as 1911 and the greater part of 1912 were dry years and mark a poor cropping period in all blocks, irrespective of age. Similarly in Block B, planted 1901, there is a setback in the tenth year, again probably emphasised and possibly hastened by the poor cropping period mentioned above. In Block C, planted 1902, the transitional stage has almost certainly been hastened by an unfavourable season and results in a drop in crop in the ninth year. Blocks D and E are affected by the presence of interplanted rubber but they also show a slowing down in the rate of crop increase in the ninth and eighth years respectively and a definite drop in production in the twelfth and tenth years respectively. Block F shows a slowing down in the ninth year and a definite setback in the eleventh year.

* "Variation in Coconuts with particular reference to fruit production". *Malayan Agricultural Journal*, 1925. Vol. XIII. Page 33.

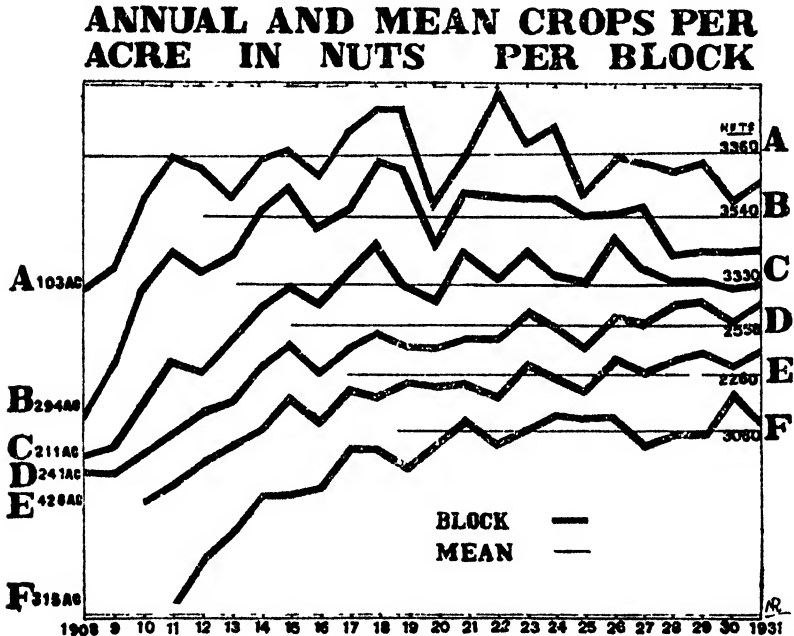
To bring out this point further, additional data were collected from two other estates in the locality, representing eleven blocks of mature palms totalling some 3,000 acres. These in every instance showed either a definite drop in crop or a decided slowing down in the rate of increased production between the eighth and twelfth years, in the majority of cases the period occurred in the tenth and eleventh years after planting.

The effects of this "transitional" or resting period therefore vary according to climatic conditions between a definite drop in crop, a more slowing down of the rate of increase of production, and a stagnant period of a year or two, and appears to be the more marked in soils in which palm growth and development are rapid.

Effects of Interplanted Rubber.

Blocks C, D, E and F were planted in 1902, 1903, 1905 and 1906 respectively and each block is well over 200 acres in area. Blocks D and E were interplanted with rubber in 1906. In 1922 the rubber was removed and in 1924 these blocks were given a fair application of artificial manures. The contrasting crops from each of these four blocks are shown graphically in the diagram which portrays the retarding effect of the rubber on the palms in Blocks D and E compared with those on adjacent blocks one year older and one year younger. The diagram also indicates the actual loss in crop due to the competition of the rubber, since the mean yields per block from the tenth year onwards are shown. Blocks C and F show normal rates of increase in crop from young palms under existing conditions until maturity is attained, and thereafter seasonal variations above and below the mean yields are indicated. Block C of 211 acres produced somewhat better crops than Block F of 315 acres, possibly because of slightly more favourable environmental conditions. Blocks D and E show similar rates of development but much slower than Blocks C and F. Thus Block F, planted one year later than Block E, exceeded it in crop returns almost from the beginning of its bearing period, and although Block D was planted three years before Block F, the latter in its third cropping year produced approximately the same crop, and by its fifth cropping year had left Block D well behind. Block D (241 acres) is a better yielding block than Block E (428 acres) but the difference is undoubtedly due to soil conditions: Block E contains some pockets of stiff yellow clay. While the blocks are liable to vary slightly in their suitability for coconut cultivation, yet it is quite evident from the graphs that the interplanting of rubber in Block D and E had a definite retarding effect on the palms. When the rubber was removed in 1922 there was an immediate increase in yields, due partly to a favourable year, but also to the improved environment. Thereafter there was a definite upward trend in the crops, no doubt assisted by the application of artificials in 1924, although poor crops were garnered in 1925 which was a bad year climatically and the manures had not had time to take effect. The mean yields from Blocks D and E from their eleventh years onwards were 2,580 and 2,260 nuts per acre respectively, whereas the mean after the excision of the rubber increased to 2,850 and 2,460 respectively. The effect of the manures

may not appear to be very marked and is masked by a good cropping year in 1926, but there is no doubt that they have assisted in the maintenance of better average crops, as prior to its application the trend of yields was inclined to be downwards. The poorest yielding field of 77 acres in Block E was very thoroughly cultivated and manured. Returns were on the down grade, falling as low as 1,700 nuts per acre in 1924. The average yield for the four years 1923/1926 was 2,150 nuts per acre. For the four years 1927/1930 returns increased to an average of 2,900 nuts per acre from this field.



Conclusions.

- (1). Coconuts planted in alluvial soil under normal European estate conditions should produce approximately five piculs of copra per acre in the eighth year—an amount which should cover all expenditure with normal commodity prices.
- (2). Full mature yields should be obtained from the twelfth year after planting.
- (3). Profitable yields should be maintained for at least 30 years.
- (4). There is a definite "transitional" period in production about 10th–11th years.
- (5). Interplanting with rubber definitely retards the rate of development of coconuts and seriously effects cropping.
- (6). During the period of full productivity, wide variations in annual yields due to seasonal and climatic factors may be expected.

NOTES ON PADI STEM BORERS

BY

H. T. PAGDEN,

Assistant Entomologist.

Corrigenda to Bulletin No. 1, Scientific Series, June 1930.

1. The parasite recorded as *Trichogramma nanum* Zehnt. has been re-examined by Dr. Ferrière who states that it is definitely *T. minutum* Riley.

2. *Sitotroga cercalella* Ol., recorded as the laboratory host for *T. minutum*, was found on examination to be in a mixed colony with *Corcyra cephalonica* Staint., and *Ephestia cautella* Walk. The colony now consists mainly of *C. cephalonica*. The insects were determined by Mr. G. E. Bryant

The following notes are a brief account of the work carried out on stem borers since the publication of Bulletin No. 1, Scientific Series and up to the end of 1930—31 padi season.

Alternate Host Plants.

During the fallow season following the 1929—30 padi season a search was made for alternate host plants of padi borers. This investigation covered the whole of the Krian District, parts of Larut and Matang and parts of Province Wellesley. Twelve new hosts of *Diatraea auricilia* Dudg., and four of *Sesamia inferens* Walk. were found. Three of these hosts were first recorded by Mr. F. R. Mason, Agricultural Field Officer, from the Sungei Acheh district of Province Wellesley and he demonstrated that padi stem borers are capable of living in quite small stemmed grasses.

The total number of plants now known to harbour one or more species of padi borer in Malaya is fourteen, excluding padi itself. These plants are shown in the following list together with two others which are doubtful hosts of *Diatraea*. The writer is indebted to Mr. W. N. Sands, Principal Agricultural Officer, Kedah, for identification of these plants.

In this list an asterisk or dagger indicates attack by *Diatraea* or *Sesamia* respectively. A circle indicates doubtful host of *Diatraea*. Numbers refer to the month in which the plant was first recorded as host. G. H. C. = first recorded by G. H. Corbett; F. R. M. = first recorded by F. R. Mason; H. T. P. = first recorded by the writer.

Alphabetical List of Host Plants.

<i>Echinochloa colona</i> Link.	† F.R.M.	5	(1930)	
<i>Elcusine indica</i> Gaertn.	† H.T.P.	7	(1930)	† Dept. Agric. (1929)
<i>Eriochloa annulata</i> Kunth.	† * F.R.M.	5	(1930)	
<i>Hymenachne Myuros</i> Beauv.	† H.T.P.	4	(1930)	
<i>Ischaemum himorens</i> Kunth.	° H.T.P.	6	(1930)	
<i>Oryza latifolia</i> Desv.	† * F.R.M.	5	(1930)	

<i>Panicum auritum</i> Presl.	° H.T.P.	6	(1930)
<i>Panicum repens</i> L.	† H.T.P.	6	(1930)
<i>Paspalum orbiculare</i> Forst.	† H.T.P.	6	(1930)
<i>Paspalum punctatum</i> Burm.	† H.T.P.	3	(1931)
<i>Saccharum officinarum</i> L.	† * H.T.P.	6	(1929)
<i>Sacciolepis myosuroides</i> Ridley	† H.T.P.	4	(1930)
<i>Scirpus grossus</i> L.	† * H.T.P.	6	(1929)
<i>Setaria rubiginosa</i> Miq.	† * H.T.P.	6	(1930)
<i>Veliveria odorata</i> Virey	† H.T.P.	6	(1930)
<i>Zea Mays</i> L.	† G.H.C.	11	(1923) † H.T.P. 5 (1929)

Under laboratory conditions *Sesamia* can feed in *Hymenachne*, *Sacciolepis* and the grass *Coelorrachis glandulosa* Staph. besides its usual hosts. *Diatraea* will also eat *Coelorrachis*.

A Pyralid, determined by Mr H. M. Pendlebury of the Selangor Museum as *Nephotyxa* sp. *sensu lato*, was found to be a common borer in the stems of *Coelorrachis* and can feed in padi but it has not been found to attack it under natural conditions.

Many of the wild hosts recorded grow in places which do not receive the attention of the padi cultivator so that there is always a ready source of infection of the padi.

No alternate host of *Schoenobius incertellus* Walk. has been found, nor has the writer succeeded in finding aestivating larvae or pupae. The writer believes that *Schoenobius* maintains itself almost entirely in self-sown and re-grown padi. In the Philippines and Japan the larvae and pupae are stated to aestivate in stubble.

Light Trap Experiment.

This experiment was to serve two purposes.

- (1) To ascertain whether light traps may be considered to be an effective control measure.
- (2) To gain information concerning the fluctuations in the population of the imagines of stem borers.

These traps were set up slightly over a quarter of a mile from the road in the Government Padi Experiment Station at Titi Serong. They were spaced at 80 yards and each consisted of a hurricane lantern standing on a block of wood in a tray, 2 feet square by 3 inches deep, containing water with a film of kerosene on the surface. Each trap was protected from rain, which might overflow the trays and thus cause loss of specimens, by an attap shelter.

Some difficulty was at first experienced in separating worn examples of the males of *Schoenobius* and a species of *Chilo*. The latter insect, however, was never very numerous in the traps and as it has never been recorded as a padi pest in Malaya it was not included in the counts.

Two of the three traps were burned for a part of the night only while the third was kept alight all night. The hours were as follows.

No. 1	. . . . .	10.00 p.m. to 6 a.m.
No. 2	. . . . .	6.30 p.m. to 10 p.m.
No. 3	. . . . .	6.30 p.m. to 6 p.m.

The graphs figures 1 and 2 show the nightly catch, and the following brief account will serve to bring out the salient points and cover the period not shown on the graphs.

It will be seen that very few moths were obtained until January 1931, when *Schoenobius* became numerous between the 10th and 24th. *Diatraea* first became numerous in mid February. It will also be observed that both these insects exhibited marked periods of increase, *Schoenobius* in January, February, March and to a lesser extent April and *Diatraea* in February, March, April and May. In the case of *Diatraea* the greatest number of females was reached on the night May 5th to 6th with 321 individuals.

Those periods of increase were more or less defined between the last and first quarter of the moon, the only exception being the last period of *Diatraea* when the maximum was reached between the full moon and last quarter.

During these periods of increase there were large nightly fluctuations, most marked for *Diatraea* in March, and it was thought at first that these might be connected with the process of harvesting which was in full progress in the vicinity of the traps during that month. Subsequent comparison of the dates of harvesting the various plots did not show any connexion with the number of moths attracted to light and as similar fluctuations occurred subsequently it would appear that the mechanical disturbance and removal of cover does not influence the response of the insects. Furthermore, there does not appear to be any connexion between nightly rainfall and these fluctuations. The natives state that wind often causes a large number of moths to come to light in houses but it was not possible to investigate this statement.

It is particularly interesting to note the large number of *Diatraea* caught after harvest and indicating a flourishing population in the various grasses in the vicinity.

The writer's observations showed that more males than females of *Schoenobius* were captured, but that in the case of *Diatraea* females predominated.

With regard to the ratio of the sexes of *Schoenobius*, Shiroki, in Formosa, has shown that females are attracted to light in greater number than males except at the time of emergence of a generation when males predominated. His results are supported by five years observations. In India Ballard has found the same to be the case and he demonstrated that out of 13,640 females captured 35.5 per cent. had already deposited their ova.

That the results obtained in the particular district of Malaya where the present investigation is being carried out should differ from those of Shiroki and Ballard is difficult to explain. It may be connected with the fact that there are no marked seasons in Malaya and that *Schoenobius*, once established on the

increase, does not appear to exhibit clearly defined generations. Again in India there are well defined wet and dry seasons which are not so marked in Malaya and this may partly explain the difference in behaviour noted by Ballard and the present writer.

The response of *Sesamia* to light was found to be very weak and no graph is shown for this insect.

It was found that the males of all three insects are attracted throughout the night but that females came more readily during the early hours.

The total number of moths caught from September 1st, 1930 up to and including June 14th, 1931 was as follows.

		Males.	Females.
<i>Diatraea</i>	...	2,700	5,184
<i>Schoenobius</i>	...	4,277	2,191
<i>Sesamia</i>	...	461	60

Damage Caused by Borers.

The experiment was planned as follows. One acre was divided into tenths and five of these were examined daily for ova of *Diatraea* and *Schoenobius*. *Sesamia* could not be included as the position of its ova within the leaf sheath rendered collection impracticable. Five trained coolies were used for this work and were supervised continuously. They were instructed to cover the half acre in three days, or a day less than the minimum recorded incubation period. It was hoped that the removal of a large number of ova would sufficiently reduce the borer population in the treated half to give some indication of the damage caused by these insects.

The result was negative.

The ova collected were kept in the laboratory to ascertain the extent of natural parasitism and the figures obtained were used as a check on induced parasitism in another area

The number of egg-masses collected were as follows:—

<i>Diatraea</i>	...	2,450 averaging 72.8 + 1.97 ova per mass *
<i>Schoenobius</i>	...	5,049 averaging 109.2 + 1.67 ova per mass *

A reduction of 10.4 per cent. in bored stems was recorded. The figures were as follows:—

Plot No.	1	2	3	4	5	6	7	8	9	10
Percentage bored stems	53	40	50	32.4	35.9	46.2	52.9	45.1	62.1	57.6

Plots 1—5 (treated) average 42.2 per cent.

Plots 6—10 (untreated) average 52.6 per cent.

Difference 10.4 per cent.

* The error is calculated on 377 and 976 actual counts for *Diatraea* and *Schoenobius* respectively.

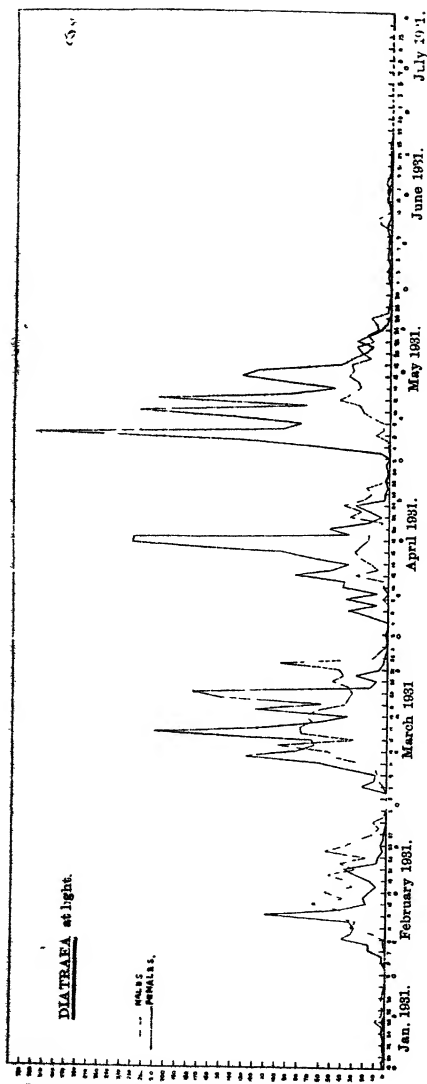


Fig. 1

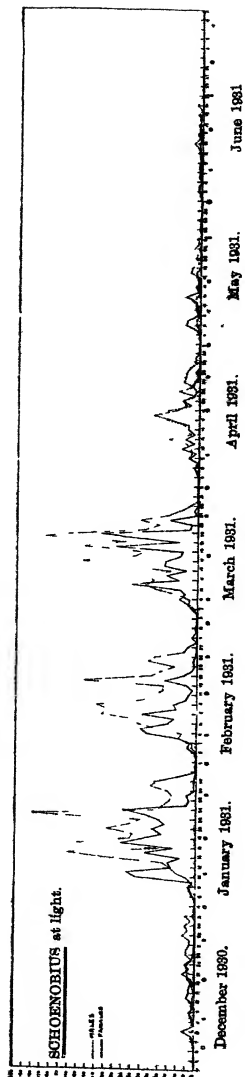


Fig. 2

The yields gave entirely contradictory results.

Plot No.	1	2	3	4	5	6	7	8	9	10
Yield	7.5	7.5	10.25	7.0	9.16	11.75	11.5	8.5	8.75	6.16

Average yield for plots 1 — 5 8.28 gallons

Average yield for plots 6 — 10 9.33 gallons

Difference 1.05 gallons.

The yields were taken from 1/40 acre in each plot and were recorded in gallons.

The following table shows the plots arranged in order of good yield, good tillering and severity of borer attack.

Yield	6	7	3	5	9	8	1 & 2	4	10
Tillering	2	5	1	4	3	6	10	7	9
Borer attack	4	5	2	8	6	3	7	1	10

It is apparent from this table that there was no connexion between yield, tillering and borer attack.

✓ Experiment with *Trichogramma minutum* Riley.

This experiment was designed on similar lines to the foregoing in so far as arrangement of plots was concerned and was situated about three miles away so that no parasite spread could take place. Parasites were liberated over this plot and over the surrounding 30 odd acres. Daily liberations were made from the time of the first transplanting until flowering and the rate of liberation was about 1,300,000 per acre.

For the purpose of estimating parasitism a daily collection of egg-masses was made as in the previously described experiment, the number collected during the whole period being 5,129 *Diatraea* and 7,756 *Schoenobius*, the average number of ova in a mass being as recorded previously.

The number of egg-masses collected daily both in this Experiment and the control is shown in the graphs Figs. 3 and 4

The results obtained against *Diatraea* were apparently promising, but it must be remembered that the number of parasites liberated was enormous and that unless equally good results can be obtained with about one hundredth of this number the parasite cannot be considered as an economic means of control.

The graph Fig. 5 shows the percentage of egg-masses of *Diatraea* in which the parasite occurred in the colonised area plotted against the natural occurrence in the control experiment. It should be stated that the percentage refers, not to individuals, but to egg-masses as a whole. It was not possible to count individual ova when the number of masses collected daily was large.

It was conclusively demonstrated that liberation of *T. minutum*, even in vast numbers, is ineffective as a control measure for *Schoenobius*, the parasite being unable to penetrate to the inner layer of ova. *Phaenurus beneficiens* Zehnt.,

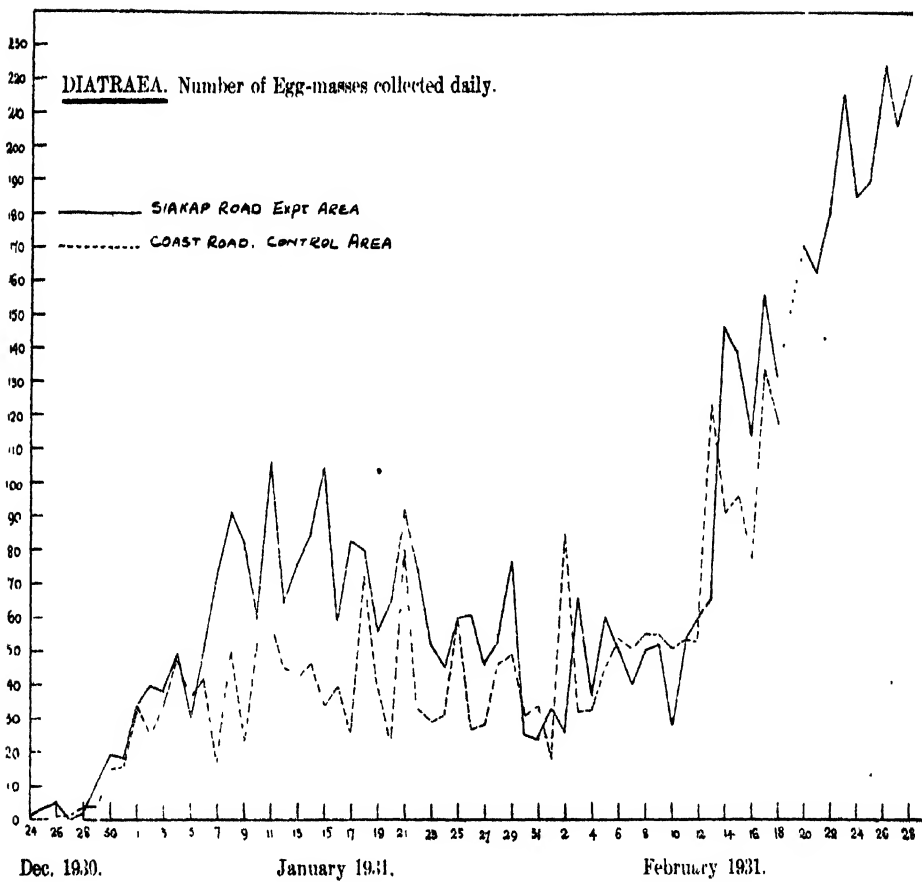


Fig. 3

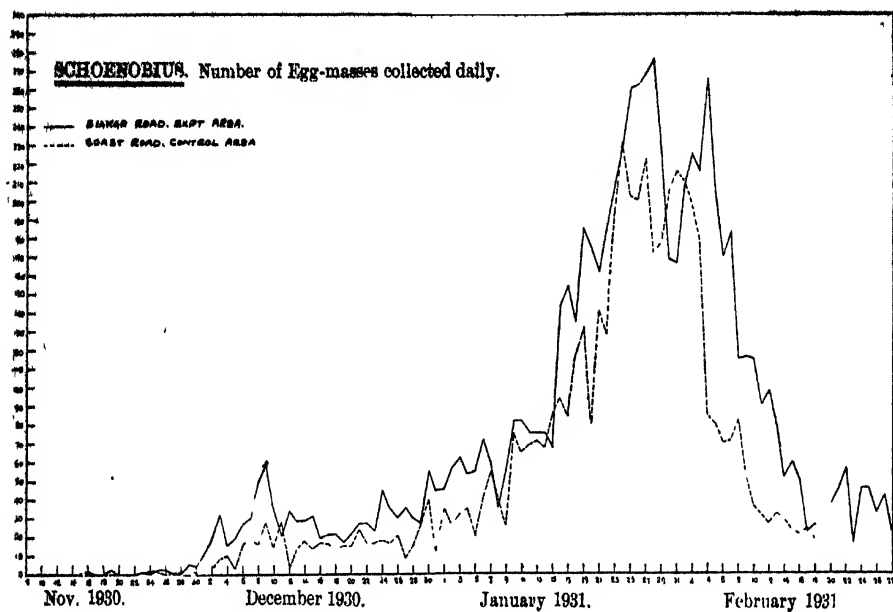


Fig. 4.

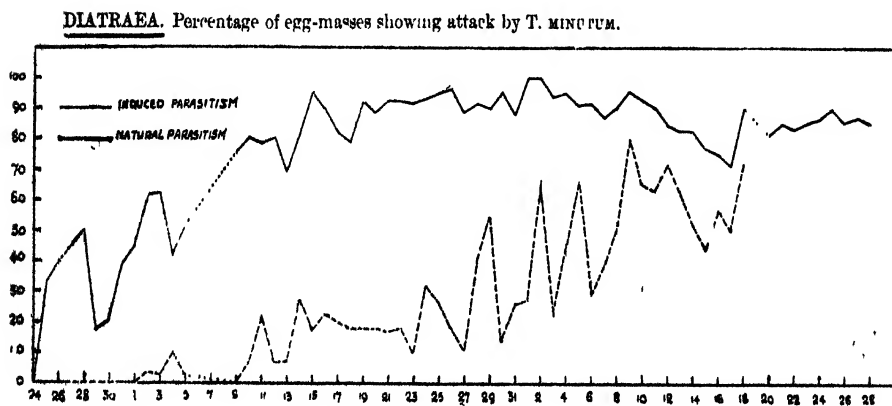


Fig. 5.

on the other hand, is a highly efficient natural parasite of this insect, but it hardly ever attacks ova of *Diatraea* in the field.

Two other parasites found to attack ova of *Schoenobius* are *Tetrastichus schoenobii* Ferrière (1931) and *Eupteronialus* sp. The writer is not certain of the identity of the latter as the name alone has been received from the Imperial Institute of Entomology, *Tetrastichus*, however, appears to be very important late in the season as its larvae, in their later stages behave as predators and devour not only ova but larvae which have hatched and remained beneath the covering of the egg-mass.

Comparison of Borer Attack in Colonised and Uncolonised areas.

The following table shows the percentage of bored stems in the areas examined. It will be seen that there was a difference between the colonised and uncolonised areas of 13 and that other areas examined suggest that the parasites are greatly affected by the prevailing wind.

Percentage Borer Attack in Areas Examined.

Control Area plots 1 — 5	42.2 per cent.
Control Area plots 6 — 10	52.6 " "
Control Area average	47.4 " "
Parasitised Area plots 1 — 5	38.8 " "
Parasitised Area plots 6 — 10	29.9 " "
Parasitised Area average	34.3 " "
Parasitised Area average over 33 acres	23.1 " "
Area to leeward of Parasitised Area	27 " "
Area to windward of Parasitised Area	42.7 " "

Yields.

The yields from the special plots in the parasite colonised area gave no better information than did those in the control. The same strain of padi, *Seraup kechil* 26, was used in both places and the land was reputed to be similar as regards productivity. It is not considered necessary to give full figures in this note. The averages are given below recorded in gantangs or gallons.

Plots 1 — 5	5	8.28
Plots 6 — 10	8	9.33
Average for all plots	6.5	8.8

Summary.

It was found that *Diatraea* ova are a natural and attractive host of *T. minutum* but are only rarely attacked by *Ph. beneficiens*. The latter insect is, however, an important natural parasite of *Schoenobius* ova.

A third parasite, *Tetrastichus schoenobii*, may prove even more efficient against *Schoenobius* than is *Phanurus* as it almost invariably completely destroys those egg-masses in which it occurs, while *Phanurus* only does this in the case of small egg-masses.

During the course of the work an egg-parasite was bred from ova of *Sesamia inferens* Walk., found in the grasses *Oryza latifolia* and *Setaria rubiginosa* and is mentioned here as it is the first record of an egg-parasite of *Sesamia* in Malaya.

Seasonal

Seasonal Variation in Borer Population.

The work has not been in progress sufficiently long to enable the writer to make any definite statement on this subject.

The evidence so far obtained suggests that there is a sequence of borers and that *Schoenobius* is the earliest to appear. In the season under discussion the ova of this insect first became numerous in late December, the imagines appearing in numbers at light in January. They almost disappeared in April.

Diatraea followed *Schoenobius* about a month later and ova were still on the increase at the end of February when egg-collection had to cease owing to flowering of the padi. The imagines first became numerous at light in February and continued until mid May.

Sesamia appears to follow *Diatraea* fairly closely but in a normally early season its occurrence would probably be too late to cause serious damage to the padi.

During the 1929—1930 padi season, which was an abnormally late one, larvae of *Diatraea* were abundant in padi until the end of May but *Schoenobius* larvae became scarce in late April and were almost absent in May although there was still plenty of food. This observation supports the view expressed above and the data at present available suggest that the date of appearance of padi borers is very little influenced by the stage of growth of the padi. If this supposition is subsequently found to be accurate it should be possible, given adequate irrigation and drainage, to advance the date of sowing sufficiently to reduce damage to a minimum.

Miscellaneous Observations.

Migration of *Schoenobius*.

During the course of field work it was found that the larvae of *Schoenobius* were capable of migration from one plant to another even with water on the fields.

The writer believes that he is correct in the statement that this fact has not been recorded previously and as the method of locomotion is peculiar a brief note may not be out of place.

The transfer is effected as follows. The larve emerges from the stem and cuts a portion of leaf somewhat longer than its own body. The leaf has a natural tendency to roll up on dessication and the larva presumably makes use of this property to obtain a tube the edges of which it weaves together with silk and finally closes one end with the same material. In this tube the larva can float on the surface of the water in a similar manner to larvae of *Nymphula*. When it encounters a stem of another plant it attaches its case at the open end by means

of a ring of silk and penetrates the stem leaving its case adhering to the exterior. Only larvae which are nearly adult appear to indulge in this practice.

Identification of Attack.

In a previous paper (7) it was stated that borer attack is distinguishable from attack by *Leptocorisa*, or other insects, and birds attacking the ear, by the complete whitening of the panicle. This statement needs modification. The writer has frequently observed plants with a number of irregularly distributed white ears and flowers. These may be due to attack by Rhynchota, Orthoptera or even birds, but are also caused by borer larvae. Both *Diatraea* and *Schoenobius* are responsible but the latter is more frequent. The whitening is caused by very young larvae entering the flowers while they are still enclosed in the sheath, feeding in these and destroying the essential organs. Panicles exhibiting this form of attack are usually distinguished on close examination by small round holes in the glumes.

Unidentified Parasites of Borers.

Various unidentified parasites of borers have been encountered. Among these the most important would appear to be a Tachinid attacking larvae of *Diatraea* and *Sesamia*. This parasite appears to attack the young larva and to emerge from the adult larva or pupa. Second instar larvae collected in the field have produced the parasite when adult. Nothing is known of its ovipositing habit.

The insect is recorded under number 6965 in the Entomological collection of the Department of Agriculture.

A Proctotrupid, No. 6971, believed to be parasitic in the larvae of *Diatraea* was obtained from material in *Sacciolepis myosuroides*.

A Trichogrammid resembling *T. erosicornis* Wstw. was bred sparingly from ova of *D. auricilia* and is recorded under No. 6972, 25.6.30.

An Ichneumonoid parasite of *Schoenobius*, No. 7602 was obtained from pupae found when making stem counts. This is the first record of a pupal parasite of *Schoenobius* in Malaya.

Diptera Bred from Unopened Inflorescences.

Various Diptera have been bred from the unopened inflorescence of padi and the grasses *Oryza latifolia*, *Setaria rubiginosa*, *Erichloa annulata* and *Sacciolepis myosuroides*. Some or all of these may prove of importance in padi cultivation. Conspicuous among them is a bluish black Trypetid with densely mottled wings. The larva of this has been found in the stem of *S. myosuroides* just below the inflorescence and appears to be a facultative predator of *Diatraea* though the larva of the latter may have died from other causes. The normal habitat appears to be the upper part of the stem and the unburst flower spike of padi and other grasses. The imago is common in padi fields where it may be observed resting on the leaves.

Other Insects Observed.

Among the Coleoptera the curculionid, *Aorus ferrugineus* Boh., has been captured at light and its larva and pupa have been obtained from the rhizomes of the sedge, *Scirpus grossus*.

A Halticid, the larva of which frequents the grass *Setaria rubiginosa*, living beneath the leaf-sheath and in the unopened inflorescence, appears to attack other grasses though it has only been bred from the above mentioned species.

The Erotylid, *Anadastus* sp., No. 6964, is a common insect in the grass *Coelorrachis glandulosa* and can feed in padi under laboratory conditions.

The Coccinellid, *Alesia discolor* F., and the Staphylinid, *Paederus fuscipes* Curt., are to a certain extent predators and have been observed devouring parasitised ova on egg-cards. The former, however, feeds in all stages on padi flowers and appears to prefer these.

Various Orthoptera, Tettigoniidae, are also a serious factor in the destruction of egg-cards and may completely destroy them before emergence of the parasite is complete.

✓ Habit of *Schoenobius* Larvae.

It has been observed that young larvae of *Schoenobius* often remain within the egg-mass for a day or two after hatching and that at the time of leaving the egg-mass only a few exit holes are made, usually at the junction of the egg-mass with the leaf, the larvae following each other through these. This habit is undoubtedly favourable to the parasite *Tetrastichus schoenobii* whose larvae behave as partial predators.

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Abstracts.

VEGETATIVE PROPAGATION.*

A fresh plant may generally be raised by two methods; from seed, or from some fragment of a parent plant other than a seed, or, as in budded seedling stock, by a combination of both methods. Seed propagation involves a sexual act, and produces a definitely new individual which may or may not closely resemble the parent type. In most orchard crops, the offspring usually show considerable variation. Vegetative propagation is not a sexual process and does not produce a new type, it merely extends the original parent type.

Considerable advantage has been taken of vegetative propagation with temperate orchard crops, and there is every reason to anticipate that a wider application of such methods to tropical crops would prove of advantage. The realisation of this will depend primarily on the discovery of methods of vegetative propagation suitable to commercial application, and secondly, in the interest shown by planters in the use of vegetatively raised stock.

The practical classification of methods of vegetative propagation may be made into :—

- (1) Rooting processes, and
- (2) Grafting processes.

The first group of methods aims at the production of new roots and shoots upon plant parts such as stems, roots, or even leaves, the new root and shoot system being eventually established as a new plant. This group may be further subdivided according to whether the new roots are formed while the organ is still retained on the parent plant, or after it has been removed as a cutting.

Thus there are :—

- (1) Layering, stooling and allied processes such as “bagging” or “marcotting”.
- (2) Cuttings, which may be either hardwood or softwood stem cuttings, root cuttings or leaf cuttings.

The second main group consists of the method of grafting, budding and approach grafting, sometimes collected under the general term “graftage”. There are many modifications of practical methods, but the basic principle is always that of inducing the tissues of two separate plants to grow together, in order to form one composite plant. In grafting or budding, a part of one plant, either a small piece of stem or a piece of bark including a bud, is removed and placed in contact with the cambial tissue of the other plant so that the tissues grow together. In approach grafting, two plants are made to grow together while each is still on its own roots, by removing the bark from portions of the stems to expose the cambium and binding the two stems together with the bared surfaces in contact.

* The following is the Summary of an article under this title (slightly extended by reference to the article), by E. E. Pyke, B.Sc., A.R.C.S. (London), published in *Tropical Agriculture* Vol. IX No. 1 January, 1932,

Advantages.

The advantages of vegetative propagation are as follows :—

(c) *Uniformity.* The extension of a type by vegetative propagation makes possible a degree of crop uniformity, both of yield and of quality, which is rarely attained in a seedling population. This uniformity is of great advantage both in the scientific and the commercial fields. In scientific work a high intrinsic variability in the experimental material obscures the variability caused by the experimental conditions; for the grower, the presence of low yielding types increases the overhead costs of the plantation.

The root stock upon which a variety is budded often has a marked influence upon the yielding capacity of the scion. If uniform yielding material is required, the variety must either be established on its own roots by root cuttings or stool shoots or else it must be budded on to a clonal root-stock. Only if the root system is clonal can a reasonable uniformity of yield be obtained.

(b). *Extension of Environmental Range of a Crop.* The isolation of individual plants, chosen for special qualities, such as cold or drought tolerance, and their subsequent vegetative propagation can increase the range of cultivation of a crop by bringing in districts which are unsuited to the average type. This is analogous to the breeding of hardy strains of wheat, when however, vegetative propagation is not necessary to fix a type, as pure genetic lines are readily raised.

(c). *Increase of Vigour of Weakly Types by working on to Suitable Clonal Root-Stocks.* In temperate horticulture it is a standard practice to work certain varieties on to vigorous stocks, thus improving either their vegetative growth or cropping capacity, or both. In tropical crops, modern breeding work will probably produce delicate varieties which require the assistance of hardy root-stock.

(d). *Propagation of Sterile Types.* Some desirable fruit varieties such as seedless oranges, grapefruit and sapodillas, are highly sterile and thus cannot be propagated by seed. In these fruits, vegetative propagation must be used to extend the variety.

(e). *Early Maturity.* A bud from a seedling may often be made to grow and bear fruit sooner than the original seedling, by working it on to a stock. This hastening of maturity would be of great value in speeding up genetic work on an orchard crop.

Disadvantages.

(a). *Initial Cost.* The first cost of a vegetatively raised nursery plant will usually be higher than that of a seedling planted at stake. However, the increased yield expected from such nursery plants should amply justify the initial increased expenditure.

(b). *The Root System.* A tap-root is by definition an organ peculiar to a seedling. However, exactly similar functioning roots can grow on vegetatively raised plants.* It is highly probable that in most orchard crops, after a certain age, the root systems of trees which grew from seedling root-stocks and those

which grew from vegetative root-stocks will be found to be indistinguishable. Even in seedlings it is doubtful whether the primary tap-root is persistent in a mature tree.

(c). *Senescence and Degeneration.* Does continued vegetative propagation necessarily result in any lack of vigour, either vegetative or sexual, in the plant? The question of senescence always arises in connection with the vegetative extension of varieties. At the present day, the occurrence of true senescence in clones on continued vegetative propagation is neither proved or disproved. However, even if some senescence were proved to occur, it would not effect very much the policy of orchard crop growers, who normally would wish to plant new varieties from time to time rather than to replant with old varieties which would have begun to wane in popular favour.

There is, however, the problem of contamination of clonal varieties by rogue plants, either of seedling or clonal origin, or by diseased plants. This contamination may materially reduce the yield from a plantation and give the impression of senile change, or "running-out", in a variety. The solution must lie in the prevention of the propagation of rogue types by care in taking bud-wood or cuttings and by vigilance in the nursery.

(d). *Problems of Sterility within a Clone and between Clones.* Self-sterility occurs in many varieties of fruit crops. Even different varieties may not be sufficiently cross-fertile to ensure sufficient setting. Some edible fruits develop with a low percentage of ovules fertilised, and in these, high degrees of sterility occur without affecting yield. In a seed crop, however, a high percentage of ovules must be fertilised as seed is rarely produced without fertilisation. In such crops, therefore, precautions must be taken against sterility by planting mutually cross-fertile varieties together.

EXPORT OF LIQUID LATEX.

In view of the continued and extended export of liquid latex from Malaya the following abstract of an article on the International Trade in Liquid Latex published in The Rubber Age (U.S.A.) Vol. 30 No. 5 should be of interest.

Shipments of latex on an important scale commenced in 1922 and Malaya and Sumatra have been the chief sources of supply while the United States of America has been the chief consuming country. It is not possible to determine the exact extent of use in particular countries, since all importing countries do not give separate statistics of imports of rubber in the form of latex.

There is however, evidence of steady growth and imports into the United States of America which during 1930 and 1931 have established new high records.

The manufacture of concentrated latex also obscures the amount of trade since, unless the dry rubber content of the latex exported or imported is given or the latex is specifically described as concentrated, ordinary and concentrated latex are classified together.

Such figures are, however, available from Malaya as an exporting country and from America as an importing country.

Similar figures in respect of the Netherlands East Indies and Great Britain would be useful.

The following figures relating to annual exports since 1922 are of interest; those for 1922 are stated to be somewhat incomplete for Malaya and Ceylon. The figures are believed not to include concentrated latex.

It can be assumed that one gallon of latex represents 3½ lbs. of dry rubber, although the actual dry rubber content, especially during recent years is probably slightly higher.

During recent years the decline in the exports from Malaya is balanced by increased exports from Sumatra (or *vice versa*) due to the principle shipper operating in both countries.*

TABLE I.

Year.	Malaya gallons	Ceylon gallons	Sumatra gallons	Total Reported gallons
1922.	40,061	1,977	228,324	270,362
1923	73,757	11,431	1,498,669	1,483,857
1924	714,617	59,288	644,859	1,418,764
1925.	2,315,439	3,750	1,432,681	3,751,870
1926.	2,087,845	13,096	28,193	2,129,134
1927.	1,560,976	251	53,572	1,614,799
1928	919,909	683	933,501	1,854,093
1929.	1,708,529	.....	833,153	2,541,672
1930.	815,186	.....	1,699,835	2,515,021

The United States imports of ordinary and concentrated latex are given in the following table.

TABLE II.

Year.	* Dry rubber Content. Pounds.	Value Dollars. (Gold).	Unit Value cts. per pound (Gold).
1924.	4,830,747	864,059	17.90
1925.	8,630,799	3,537,810	40.98
1926.	7,589,165	4,680,386	61.65
1927.	2,499,906	876,077	35.05
1928.	9,334,927	2,185,579	23.41
1929.	8,351,487	1,787,997	21.40
1930.	9,966,527	1,506,804	15.12
1931. (10 months).	9,190,362	801,935	8.73

The total dry rubber in pounds given in the table above for year previous to 1930 are therefore larger, since it may be taken for granted that a more correct figure for dry rubber content is $3\frac{1}{2}$ lbs. instead of 3 lbs.

It will be observed that the unit value per pound of rubber is considerably higher than for raw rubber exported as such. This is due partly to the fact that latex at present commands a premium as a special product and partly because preserving, packing and freight charges are higher per unit of rubber content.

(It is of interest to note that an increasing number of estates in Malaya are now exporting preserved latex, although in the aggregate the exports have decreased since the United States Rubber Company Process Department has ceased the purchase and export of latex from Malaya and confined their attentions to exports from Sumatra. B. J. E.).

B. J. E.

* Prior to March, 1930, the dry rubber content of latex imported was estimated at three pounds per gallon. There is some reason for believing $3\frac{1}{2}$ lbs. a better estimate. Since March, 1930, importers have been required to report the dry rubber content on declarations of imports of latex and latex concentrates at time of entry.

Departmental.

FROM THE DISTRICTS.

The Weather.

In the State of Kedah, in Malacca Territory and in Singapore Island the weather throughout February was hot and dry with strong North Easterly winds in Kedah, where conditions were ideal for the padi harvest. In Krian and the north of Perak, however, the weather was wet. Elsewhere in the Peninsula the first half of the month was hot and dry often with strong breezes and cool nights, while showers or thunderstorms of varying frequency and intensity were experienced in the latter portion of the month. On the East coast, where strong winds prevailed, rain storms gave a heavy precipitation in a few days.

Remarks on Crops.

Rubber :—There was a further decrease in the prices of small-holders' rubber which ranged in dollars per picul from 7—12.50 for smoked sheet, 5—10.50 for unsmoked sheet, 2—6.50 for lump and slab and 1.50—6 for scrap.

Wintering continued throughout the month, leaf fall on the whole being definite and complete, while in some areas the new leaf had begun to develop at the end of the month.

As a result of the decreased yields usual at this season, certain estates were rested and tapping was also discontinued on a number of the properties of intermediate size owned by Chinese and Chettiars. Moreover, the number of small holdings in tapping was further reduced by the incidence of the padi harvest, since many owners and even hired tappers, still employed on the share system, were either engaged in reaping their own crops or were working for wages in the padi fields.

Dry weather and in places cessation of tapping have caused a further reduction in the prevalence of Mouldy Rot Disease in most infected areas. No cases of Oidium Leaf Mildew were reported.

Padi :—In all the more important rice areas the harvest was in full progress during the month. It was completed in some Districts of Negri Sembilan and was nearing completion in Malacca and Pahang West. Weather conditions were favourable everywhere, except in Krian which experienced the difficulties due to a wet harvest. Both in Kedah and Krian the temporary shortage of labour continued. Yields so far obtained confirm the anticipation of a good crop in Kedah, Province Wellesley North and Malacca with satisfactory returns in most other parts of the country not affected by the December floods. In Malacca one of the selected strains, Siam 29, has given yields considerably in excess of the local unselected Siam variety and can now be recommended for wider distribution. The price of padi at the Government mill at Bagan Serai was 7.5 cents a gantang, while elsewhere in the north the range was from 5.5—7 cents. In other parts of the country prices varied from 6 to as much as 16 cents a gantang.

In some parts of Selangor preparations are being made to plant a five months' inter-season crop and so to obtain two crops during the next twelve months.

Some 6,000 gantangs of seed have been sent from Malacca to the east coast of Pahang for early planting in the fields where the crop was destroyed by the floods.

Coconuts :—Heavy mortality has been noted in the coconut palm area between Batu Pahat and Benut on the west coast of Johore. The reason assigned for this is repeated flooding of some parts of the area during periodic high tides. Much of this area cannot be effectively drained, with the result that stagnation of the soil water and inundation by salt water appear to be the factors mainly responsible for the debility and subsequent death of the palms.

Tobacco :—Interest in this crop is on the whole well maintained, though prices are becoming stabilised at figures below those first obtained in districts where the crop is no longer new. The usual range of prices has been between \$15/- and \$10/- per picul, but in Selangor 5 piculs of cured leaf were sold locally at \$70/- per picul, while in Pahang West 3 piculs of cured leaf sold for \$40—\$45 per picul and 2 piculs of prepared tobacco at about \$1/- per kati.

Pineapples :—It is now being realised that during the next two or three years considerable areas of pineapples will be removed as the rubber with which they are interplanted becomes mature. This fact compared with the improved prices paid for fruit by the factories during the last few months, has revived interest in pineapple cultivation and led to consideration of the possibility of using this plant as a main crop rather than as a catch crop with rubber. Interested growers are endeavouring to obtain extensive tracts of land for planting. There is still much land in Johore eminently suitable for this crop, except that it is situated at a considerable distance from existing factories, so that questions of transport require careful consideration.

Rat Control in Padi Fields :—In Krian since control measures in the padi field are no longer required, attention was directed towards known breeding grounds, dwellings and their surroundings providing harbours for rats. The only breeding season observed since July 1931 commenced during the month. The breeding season also appeared to have commenced in Malacca where 47,940 rat tails were collected, many being obtained by digging open holes in the bunds of the padi fields.

Agricultural Stations and Padi Test Plots.

KEDAH. Telok Chengai Rice Station and Padi Test Plots.—Harvesting of certain of the more important experimental fields, including the manurial experiments and ear to row lines of selected local varieties, was completed at the Rice Station under favourable weather conditions. Yields and other data were recorded. Harvesting at the Jitra and Langgar Test Plots was also completed but at the Sala Kanan and Rantau Panjang plots the padi was not fully ripe.

PROVINCE WELLESLEY. Glugor Padi Test Station.—Harvesting of two varieties, Sm 29 and R 4, commenced towards the end of the month; the former proved a shorter season padi in Penang than elsewhere, having ripened consider-

ably before the other six-months varieties. Nurseries were prepared and seed sown in the middle of the month for the trial inter-season crop.

Bukit Merah Padi Test Station.—Harvesting was commenced and under ideal conditions except for one variety F 756. Some of the varieties have given exceptionally good yields, though the final figures are not yet available. A demonstration was given to 35 local headmen and prominent cultivators at this station before harvesting commenced. Much interest was aroused, especially in the irrigation system.

PERAK. (a) Agricultural Stations. Selama.—Rainfall during the month was adequate and it was hoped that this would give the necessary impetus to such recently planted material as survived the harmful effect of the drought in January.

Kuala Kangsar.—Part of the Station received an application of pen manure. Four varieties of sweet potato and a beds of Ubi Kling and brinjals were planted. A limited number of rambutan marcots and a bed of seedling avocado pear trees were ready for sale. The preparation of the beds for the sireh garden was completed. Chickens obtained by crossing a pure-bred Rhode Island Red Cock with local hens have proved considerably hardier than the pure bred Rhode Island chickens.

(b) Padi Stations and Test Plots. Talang.—Harvesting commenced in the first week of the month and had not been completed at its close.

Leenggong.—The crop on this plot was harvested during the month and the work of cleaning the padi in preparation for weighing was commenced.

Bruas.—Reaping was slow owing to uneven ripening while some of the heavy Seraup strains which had lodged proved troublesome to cut. The crop was likely to prove better than was at first anticipated.

Bukit Gantang.—Harvesting commenced on February 22nd. The plot was visited by the headmen of the District on February 18th and keen interest was evinced.

Kamunting Slimed Area.—Birds continued to ravage the crop throughout the month, so that it will only be possible to obtain fairly representative yields in two blocks. This is unfortunate as the crop, contrary to expectations, gave evidence towards maturity of being capable of yielding a satisfactory return.

Selinsing Manurial Trials.—Harvesting was commenced and completed during the month. Calculations were not completed, but rough computations show that yields varying between 251 and 344 gantangs per acre were obtained.

SELANGOR. Cheras Agricultural Station.—The work of planting up this Station continued; three varieties of tobacco were transplanted into the field and six varieties of betel nuts were sown in the nursery beds.

Kajang Test Plot.—Nursery beds of padi were sown at the adjoining Cheras Station in preparation for planting an inter-season crop.

Kuang Padi Station.—Clearing was commenced in preparation for the short inter-season crop and nurseries of N27 were sown.

NEGRI SEMBILAN. Rembau Agricultural Station.—Crops planted were marcots of chicku and rambutan, greater yam, suckers of two varieties of bananas

and a bed of Salisbury White Maize. Cover crops were dug in or used as a mulch and vacant spaces were sown with *Crotalaria usaramvensis* as a green manure.

Rembau Padi Test Plot.—Plots of F756 and F11 were harvested.

PAHANG. *Kuala Lipis Agricultural Station.*—Grape-fruit marcots were taken for the Temerloh Station and others were prepared. The banana plot was supplied and plots of Soya bean and Virginia tobacco were sown.

Pekan Agricultural Station.—Several potatoes and vegetables were planted. The dry padi plot was harvested and the crop cleaned.

Padi Test Station, Dong.—Harvest was completed. The special sub-plots for experimental error trials were harvested, weighed and recorded.

Padi Test Station, Temerloh.—The nursery was prepared and sown with Radin 4, Radin 7 and Seri Ager strains.

MALACCA. *Sungei Udang Agricultural Station.*—The clean-clearing and stumping of the padi area was completed and preliminary work for the irrigation of this area was carried out. The preparation of the root crop area was completed. Terracing of the coffee area was in progress. Five varieties of tobacco were sown in the nurseries.

Pulau Gadong Padi Station.—Harvesting was completed and the work of cleaning and weighing the crops from the various plots was continued throughout the month.

SINGAPORE. *Pineapple Experiment Station.*—All plots of the Green Dressing Experiments with pineapples have been prepared for replanting, a dressing of artificial fertiliser will be applied before planting to assist the growth of the green manure plants on the somewhat exhausted soil.

A number of seeds of rambutan, pulasan, mangoesteen, jack fruit and chiku have been planted. Certain small plots and nursery beds have been planted with four kinds of tobacco to provide seed. A total of 61 plots each 1/40 acre, have been laid out for manurial experiments with the Hickory Prior variety of Virginia tobacco. The planting up of these plots was commenced towards the end of the month.

School Gardens.

The great majority of these gardens were closed for the year and padi planting holiday. Where as in Penang Island, the Dindings, parts of Perak and Selangor, work was recommenced during the month, it was confined to the cultivation and preparation of the beds for planting.

A commencement was made to establish school gardens in Johore State. Four selected sites were visited and approved as suitable.

In Singapore Island instructions were given for fertilising the beds and in some cases for extending the gardens.

DEPARTMENTAL NOTES.

Mycological Work.

In addition to the research work in progress, the Mycological Division of the Department deals with a large number of enquiries from all parts of the country. In one month recently, twenty-two specimens of plants attacked by fungus were submitted for examination and report. These specimens came from various parts of Malaya and included tea, coconuts, tobacco, oil palm, sireh, coffee, croton, bracken and chengai, besides rubber latex and paint.

Retirement of Mr. F. G. Spring.

Mr F. G. Spring, N.D.A., U.D.A., F.L.S., Agriculturist (Rubber) retired from the service on 5th February, 1932.

Mr. Spring joined the Department of Agriculture, S.S. and F.M.S. as Superintendent of Government Plantations on 23rd September 1910. Two years later he was promoted to the post of Agriculturist and served in this office until the end of 1924, when he was appointed Agriculturist (Rubber).

In 1927 Mr. Spring was seconded to the Co-operative Societies Department where he served for over four years. During his period of service with that Department Mr. Spring carried out a survey of the conditions with regard to native manufacture of rubber which resulted in an important report on recommendations for Co-operative Societies among small-holders for the preparation and marketing of their rubber. He later supervised the work of commencing the first co-operative rubber factory amongst Malays in this country.

During his long service in the Department of Agriculture, Mr. Spring published in its official organs a number of valuable articles dealing with the results of research work carried out on the Government Plantations chiefly in connection with rubber, but dealing also with a number of other crops. In his official capacity he was responsible for the successful introduction of a number of economic and ornamental plants.

His colleagues in the Department of Agriculture extend to Mr. Spring their best wishes on his retirement from the service.

Agricultural Office, Singapore.

The office of the Agricultural Field Officer, Singapore, has now been moved to the 5th Floor, Fullerton Buildings, Singapore.

Pigs for Sale.

Attention is directed to the offer of sale of over 30 pigs from the Government Stock Farm, Serdang, particulars of which will be found in the advertisement pages of this issue.

The pigs include Black, and crosses between Chinese sows and Black, and Chinese sows and Middle White, which have been bred on the Stock Farm.

Applications should be addressed to the Senior Assistant Agriculturist, Serdang, Selangor.

Vernacular Publications.

The last issue of the Malay quarterly journal of the Department (*Warta Perusaha'an Tanah*) is an extra large number, consisting of a free translation of Special Bulletin General Series No. 1 "The Culture of Vegetables in Malaya" by B. Bunting and J. N. Milsum, but omitting reference to crops only suitable for cultivation in the Highlands. In view of the anticipated increased demand for this number owing to its general utility, especially in connection with school gardening, 10,000 copies have been printed. This illustrated publication is available for free distribution to small-holders in the Federated Malay States and Straits Settlements. Outside this area, the price is 15 cents per copy.

Statistical Work.

The agricultural statistics for the Federated Malay States and Straits Settlements for the year 1931 are being compiled. In relation to rubber, the annual statements include area planted in 1931, area of tappable and immature rubber at end of 1931, area budgrafted in 1931, all in relation to estates of 100 acres or over.

Statistics are also being compiled of the planted area of oil palms and crops of palm oil and kernel for 1931.

It is possible that newly planted estates exist which have not been reported to this Department. Owners or managers of rubber or oil palm estates who have not yet rendered these returns for 1931 are requested to notify the Department, when the requisite forms will be sent for completion and return.

Leave.

Mr. F. de la Mare Norris, Principal Agricultural Officer, Johore has been granted 9 months and 18 days leave on full pay with effect from 5th February, 1932.

Mr. R. B. Jagoe, Assistant Botanist, returned from leave of absence on 5th February, 1932.

Statistical.

MARKET PRICES

February, 1932.

The Chinese New Year and the "Hari Raya Puasa" holidays, both falling at the beginning of the month, curtailed business on a listless market, resulting in a small volume of business with little alteration in prices. Later, however, an improvement was noticed, the Tariff proposals at Home possibly exercising some influence.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 8.18 cents per lb. in Singapore, as compared with 9.92 cents for January. The London average price was 2.71d. and New York 3 95 gold cents per lb. as compared with 3.05d. and 4.49 gold cents respectively in January.

Palm Oil.—Cabled quotations C.I.F. Liverpool on a basis of 18 per cent F.F.A. during February were as follows:— February 3rd, 10th. and 17th. £21 per ton, February 24th. £21.10. The market has been steady.

Copra—The market for this product experienced a sharp rise from \$6 per picul for Sundried at the beginning of the month to \$7.05 on 22nd, followed by a rapid fall to \$6.45. The rise was in sympathy with the demand from Europe and America. A contributory cause to this advance is probably the uncertainty in regard to the Soya bean crop as a result of hostilities between China and Japan. The subsequent fall in price may have been due to some extent to the announcement that Soya beans are to be on the United Kingdom "free list" as regards Tariff proposals.

The Singapore average prices in February were: Sundried, \$6.62; Mixed, \$6.15 per picul as compared with \$5.73 and \$5.20 respectively in January.

Copra cake was quoted in Singapore at \$2.20 per picul throughout the month.

Coconut Oil.—The average wholesale export price of coconut oil in Singapore for the month of February was \$11 per picul.

Gambier.—No. 1 Cube gambier averaged \$20 per picul on the Singapore market, while the average nominal price of Block gambier was \$13.12 per picul.

Rice—The average declared trade value in January of imports of rice of all sorts was \$4.23 per picul, as compared with \$4.24 in December.

The retail market prices in cents for gantang of No 2 Siam rice in January were:—Singapore 32, Penang 38, Malacca 27, as compared with 32, 36 and 26 respectively in December last.

Arecanuts.—During February, Palambangs averaged \$3.62 per picul in Singapore as compared with \$3.88 in January. Bila Whole averaged \$3.76 against \$3.97 in January. For other grades the average prices in February were:—Split, \$4.37 to \$5.79; Sliced, \$8.37 to \$12.62; Red Whole, \$7.44 to \$8.31—all per picul, the price within each range depending upon quality.

Coffee.—Prices for both Java Robusta and Palambang have ruled high owing to a good demand for the Bombay market. The average price of Palembang in

February was \$15.69 per picul as compared with \$17.75 in January. Java Robusta averaged from \$22.75 to \$24 per picul in February, the price within these limits depending upon quality.

Pineapples.—Singapore prices firmed, but prices in London for the forward positions are below canners' ideas. Towards the end of the month prices eased in anticipation of the summer "pack" which commences in March. Average Singapore prices per case in February were:—1½ lb. cubes, \$3.89; 1½ lb. sliced flat, \$3.57½; 1½ lb. sliced tall, \$3.80, as compared with \$3.92, \$3.80 and \$3.69 respectively in January.

Tapioca.—Average prices per picul for February were:—Flake fair, \$3.14; Pearl, seed, \$4.44; Pearl, medium, \$4.46; as compared with \$3.20, \$4.45 and \$4.70 respectively in January.

Sago.—There was improved interest by both European and Eastern buyers, resulting in better prices. The demand, however, eased off at the end of the month. The following are the average Singapore prices per picul in February:—Pearl, small, fair, \$4.37½; Flour, Sarawak, fair, \$2.70. Corresponding prices in January were \$4.42 and \$2.72 per picul.

Nutmegs.—Singapore prices remained fairly steady throughout February. Average prices per picul for the month were:—110 per lb., \$28; 80 per lb., \$31.75 as compared with \$27.30 and \$30.40 respectively in January.

Macis.—Average Singapore prices per picul in February were:—Siouw, \$59.75; Amboina, \$46.75.

Pepper.—London stocks showed a considerable increase of pepper shipped to "optional" ports, probably due to heavy landings prior to the imposition of duty. Average Singapore prices per picul in February were:—Singapore Black, \$23.87½; Singapore White, \$30.87½; Muntok White, \$31.50 as compared with \$23.50, \$30.70 and \$31.70 respectively in January.

Cloves. Prices have been nominal and unchanged in Singapore at Zanzibar \$48 and Amboina \$50 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in February and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

NOTE.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.

January, 1932.

Malaya.—Gross foreign imports of rice during January 1932 amounted 51,021 tons as compared with 69,300 tons for the same month last year, of which 61.1 per cent. were consigned to Singapore, 15 per cent. to Penang, 7.2 per cent. to Malacca, 15.4 per cent. to the Federated Malay States and 1.3 per cent. to the Unfederated Malay States.

Of these imports 56.3 per cent. were from Siam, 42.5 per cent. from Burma, 0.5 per cent. from French Indo-China and 0.7 per cent. from other countries.

Total foreign exports of rice in January 1932 were 16,684 tons, of which 83 per cent. went to the Netherlands East Indies.

The area and production of rice in Malaya for the season 1930—31 was 707,686 acres and 259,735 tons, respectively, as compared with 657,198 acres and 154,318 tons 1929—30, increases of 7.7 per cent. and 68.3 per cent. The season 1929—30 was marked by drought, while the following crop was a good one.

The padi reports indicate that work for the current season 1931—32 is in hand in all areas and harvesting in progress in places, notably in Perlis and Kedah. Crop prospects in Perlis are said to be excellent.

India.—Total foreign exports of milled rice during November 1931 were 135,000 tons an increase of 25,000, or 22.7 per cent. over November 1930.

From January to November, 1931, the total foreign exports of milled rice were 1,941,000 tons a decrease of 21.7 per cent. as compared with the corresponding period of 1930, and a decrease of 8.9 per cent. as compared with the corresponding period of the past six years.

The Fourth Forecast of the Rice Crop in Burma for the season 1931—32 gives the area likely to mature as 12,019,400 acres, being 4.6 per cent. less than the final figures of last year. The unusually dry November and general lateness in sowing and transplanting is responsible for a decrease of 71,000 acres in the area estimated to have matured.

Burma exports of rice and rice products (including exports to India) from January 1st to December 26th, 1931, were 3,498,124 tons as compared with 3,421,574 tons for the same period of the previous year, or an increase of 76,550 tons (2.2 per cent.).

Siam.—Exports of rice from Bangkok for December 1931 were 116,016 tons, an increase of 41 per cent. as compared with December 1930 and an increase of 9.4 per cent. as compared with the December average for the previous five years.

The Second Forecast of the 1931 Rice Crop states that the area planted in the Seven Inner Circles at the end of December 1931 amounted to 4,480,000 acres, being 140,000 (3 per cent.) less than the final figures of 1930. The area to be harvested is placed at 3,720,000 acres and the damaged area at 760,000 acres. The yield is estimated at 2,214,000 tons of padi and the amount available for

export during the present season from the Seven Inner Circles at approximately 1,314,000 tons of padi, or about 1,000,000 tons of rice.

Netherlands Indies.—Java and Madura. It is stated that the area harvested for the season 1931—32 amounted to 8,657,250 acres, a decrease of 1.6 per cent. as compared with 1930; the area damaged 446,030 acres, an increase of 90 per cent. over 1930, and additional plantings awaiting harvest to 2,975,250 acres, an increase of 0.5 per cent. as compared with the previous year.

The production is estimated at 6,117,421 tons of padi, a decrease of 7.6 per cent. over the previous year.

The production of dry padi is estimated at 535,714 tons of padi, being the same as in 1930.

French Indo-China.—Entries of padi at the port of Cholon for January 1932 were 81,096 metric tons, an increase of 65.2 per cent. as compared with January 1931.

Exports of rice from Saigon for January 1932 were 77,508 metric tons, an increase of 52.9 per cent. over those of January 1931. Both the padi and rice markets are stated to be quiet.

Ceylon.—Imports for the year 1931 were 436,667 tons, a decrease of 26,366 tons (5.7 per cent.) as compared with 1930. Of these imports, 16.3 per cent. were from British India, 75 per cent. from Burma and 8.7 per cent. from other countries.

Europe.—The quantities of rice shipped from the East were:—

- (a) To Europe, period 1—21 January 1932, 35,255 tons, an increase of 83.6 per cent. Of this total 91.1 per cent. was from Burma.
- (b) To the Levant, period January 1st to December 4th, 1931, 67,120 tons, an increase of 218.2 per cent. as compared with 1930.
- (c) To the West Indies and America, period January 1st to December 3rd, 1931, 152,997 tons, a decrease of 23.7 per cent. as compared with 1930.

General.

The following is a summary of the principal facts which according to the International Institute of Agriculture monthly Crop Report for December 1931 have become available in the 1931—32 rice crop.

Exporting Countries:—

- (a) Burma, a decrease of 2.2 per cent. in the planted area.
- (b) Indo-China. A decrease in area planted of 10 per cent. in Cochin-China and 23 per cent. in Annam. There is no information regarding Cambodia.
- (c) Among the minor exporting countries, Italy has had a yield below normal, Spain a small production, and the United States an increase of 5 per cent. above the average.

Importing Countries:—

- (a) In India an increase in the area planted.

- (b) In China the prospects are doubtful; the unprecedented floods of last summer destroyed a large proportion of the young rice of at least half the rice crop of China at a time when it was too late to replant, and is bound to affect the supply situation.
- (c) In Japan proper the crop is estimated to be the lowest in recent years and 18 per cent. below that of 1930—31; in Formosa, the first crop, which is that exported to Japan, exceeded the record of 1930—31; in Korea, a decrease of 17 per cent. from the large production of the previous season and 7 per cent. above the average of the five years ending 1929—30.
- (d) In Java, the production of wet rice is 4 per cent. below that of last year and 1 per cent. below the average, and for dry rice is 10 per cent. below last year and 1 per cent. above the average.

“Taking the situation as a whole, it appears that while, excluding Siam, for which estimates are not yet available but in which a considerable diminution in production is probable, the serious crisis in the great rice-exporting lands is reflected in a decline in area sown this year, the position in the principal rice-consuming countries in the immediate future appears unfavourable. Taking into account also the stocks still existing in the exporting and importing countries, the prospects of all the available supplies being absorbed remains, despite the smaller crop of 1931—32, doubtful. Prices remain at the low level registered in the earlier months of 1931, having recovered from the further drop that reached its lowest point in June. Amongst the great exporting countries, Indo-China seems, owing to the fall in sterling, likely to suffer still more severely from the competition of Burma. While, however, there are many doubtful factors in the present situation, further reductions in area in the coming season and an improvement in the purchasing power of the great consuming regions, especially of China, would bring distinct improvement in the market.”

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1931.

PRODUCT	NET EXPORTS IN TONS			
	Decr. 1930	Decr. 1931	Year. 1930	Year. 1931
Coconuts, fresh ...	665	1,900	10,475	10,468
Copra ...	7,344	9,810	102,014	100,809
Coconut Oil ...	735	874	9,475	9,909
Palm Oil ...	290	649	3,211	4,574
Palm kernels ...	54	82	485	726
Pineapples, canned	5,353	7,170	57,689	59,457
Tapioca ...	2,288	2,570	31,195	28,257
Arecanuts ...	1,924	1,740	23,254	19,266
Tuba root ...	3½	6	55½	74

ACREAGES "OUT OF TAPPING" FOR THE MONTH
OF JANUARY, 1932.

(Estates of 100 Acres and over in F.M.S. and S.S.)

TERRITORY	TAPPABLE AREA OUT OF TAPPING		TOTAL AREA UNTAPPED*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Perak ...	7,799	26,839	34,638
Selangor ...	11,876	37,030	48,906
Negri Sembilan ...	13,262	22,174	35,436
Pahang ...	2,607	4,660	7,267
TOTAL F.M.S. ...	35,544	90,703	126,247
Province Wellesley ...	2,882	8,465	11,347
Dindings ...	194	1,140	1,334
Malacca ...	4,120	16,837	20,957
Penang ...	797	49	846
Singapore ...	10,239	5,796	16,035
TOTAL S.S. ...	18,232	32,287	50,519
GRAND TOTAL ...	53,776	122,990	176,766

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. and S.S. during January (not included in the above figures) were :—F.M.S. 44,097 acres, S.S. 15,171 acres, Total 59,268 acres.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVENUES,
FOR THE MONTH OF JANUARY, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by estates of 100 acres and over				Imports				Exports including re-exports				Stocks at end of month			
	Ports		Dealers		during the year 1931		during the year 1931		during the month		during the year 1931		during the month		during the year 1931		Ports		Dealers	
	1	2	3	4	5	6	7	8	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	17	18	19	
MALAY STATES.—																				
Federated Malay States	18,000	12,226	13,938	13,938	9,455	9,455	Nil	Nil	Nil	13,029	8,614	13,029	8,614	...	...	18,352	13,597	
Johore	2,446	3,413	4,108	4,108	4,293	4,623	Nil	Nil	9	914	7,488	914	7,488	...	...	2,619	3,578	
Kedah	448	2,159	2,728	2,728	1,343	1,343	Nil	Nil	Nil	630	3,004	630	3,004	...	...	505	2,539	
Perlis	27	7	7	7	20	20	Nil	Nil	Nil	Nil	33	Nil	33	...	...	20	8	
Kelantan	160	42	83	83	583	583	Nil	Nil	Nil	34	545	34	545	...	...	226	63	
Trengganu	55	50	117	117	58	58	Nil	Nil	Nil	Nil	175	Nil	175	...	...	55	50	
Total Malay States	21,136	17,897	20,981	20,981	16,082	16,082	Nil	9	Nil	14,607	19,859	14,607	19,859	...	...	21,777	19,835	
STRAITS SETTLEMENTS																				
Malacca	5,658	1,264	1,628	1,628	(2)	(2)	Nil	Nil	Nil	5,027	Nil	5,027	Nil	...	...	4,470	1,349	
Province Wellesley	102	535	571	571	2,392	2,392	Nil	Nil	Nil	6,166	Nil	6,166	Nil	...	...	95	630	
Dindings	128	91	116	116	9	9	Nil	19,912	Nil	9,912	9,912	9,912	9,912	...	...	126	96	
Penang	1,638	6,230	9	9	9	9	944	944	944	16,838	Nil	16,838	Nil	2,958	7,014	13	13	
Singapore	3,099	38,603	287	173	173	173	7,083	7,083	7,083	28,031	Nil	28,031	Nil	4,155	41,018	236	236	
Total Straits Settlements	4,737	50,721	2,186	2,497	2,392	2,392	8,027	8,027	8,027	19,912	28,031	19,912	28,031	7,113	52,723	2,336	2,336	
TOTAL MALAYA	4,737	71,857	20,083	23,478	23,478	18,474	8,027	19,921	8,027	19,921	42,638	19,859	42,638	19,859	7,113	74,560	22,161	

TABLE II

DEALERS' STOCKS, IN DRY TONS. 3

Class of Rubber	Fede- Malay States	S'pore	Penang	W'vly D'ngs	Johore	Total
	21	22	23	24	25	26
DRY RUBBER	15,265	37,184	6,676	4,446	1,154	64,725
WET RUBBER	3,087	2,894	338	245	1,465	8,969
TOTAL	18,352	41,018	7,014	4,691	2,619	73,694

TABLE III
FOREIGN EXPORTS

Ports	For the year 1932
	during the year 1932
Singapore	23,990
Penang	9,309
Port Swettenham	6,590
Malacca	2,749
MALAYA	42,638

TABLE IV
THE PROPORTION OF FOREIGN
EXPORTS REPRESENTING
DOMESTIC PRODUCTION. 4

Area	For the year 1932
	during the year 1932
Malay States	84,106
Straits Settlements	34,106
MALAYA	118,212

Notes:— 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, i.e., Column (7) = Column (13) + [14] + [17] + [18] + [19] + [10A] - [1] - [9] - [4] - [5] - [19] - [10]. For the Straits Settlements, Columns (7) and (8) represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; unsmoked block, 20%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of domestic production representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 28th February, 1932.

METEOROLOGICAL SUMMARY. MALAYA, JANUARY, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE PERATURE			RAINFALL						BRIGHT SUNSHINE			
	Means of			Absolute extremes						Total		Number of days				Total	Daily Mean	Percent
	A	B	Min	Max	A and B	Highest	Lowest	Min	Max	At 1 foot	At 4 feet	Precipitation, 0.1 in or more	Thunderstorm	Fog morning or afternoon	Gale force 8 or more			
Railway Hill, Kuala Lumpur, Selangor	88.5	70.0	79.3	94	67	79	73	82.1	83.0	4.96	126.0	180	11	11	2	214.55	6.92	57
Bukit Jeram, Selangor	87.1	71.0	79.0	89	68	82	73	83.2	84.7	4.91	124.7	238	10	8	1	233.00	7.52	63
Sitiawan, Perak	88.7	69.9	79.3	91	67	82	74	82.4	83.2	6.27	159.3	212	13	9	3	238.05	7.68	65
Kroh, Perak	84.4	67.2	75.8	89	64	77	71	78.4	80.2	0.88	22.3	0.40	7	5		252.35	8.14	69
Temerloh, Pahang	84.0	69.6	76.8	88	64	75	74	80.6	82.9	7.45	189.2	343	19	13	3	159.70	5.15	33
Kuala Lipis, Pahang	83.8	69.1	76.5	88	65	78	72	80.3	81.8	8.99	228.3	448	18	13		147.05	4.74	39
Kuala Pahang, Pahang	82.3	74.5	78.4	83	71	80	77	80.1	81.3	4.32	109.7	108	25	17		155.50	5.02	42
Mount Faber, Singapore	84.9	71.9	78.4	90	67	79	74	78.9	80.7	6.52	165.6	165	15	12		176.70	5.70	47
Butterworth, Province Wellesley	88.7	71.5	80.1	93	68	84	74	82.2	83.9	0.87	22.1	0.47	5	4		265.00	8.55	72
Bukit China, Malacca	85.0	72.0	78.5	89	70	74	74	79.9	81.7	2.99	76.0	119	9	7		223.30	7.20	60
Kluang, Johore	83.5	71.1	77.2	89	67	75	73	78.8	80.5	8.03	204.0	271	14	11		168.00	5.42	45
Bukit Lalang, Merang, Johore	80.4	73.6	77.0	82	71	78	76	77.4	78.9	7.25	184.2	184	20	15		131.20	4.23	35
Alor Star, Kedah	88.5	69.0	78.7	92	65	84	75	81.3	83.8	0.06	1.5	0.05	2	1		278.95	9.00	76
Kota Bharu, Kelantan	82.2	70.3	76.3	85	65	79	75	79.2	81.7	1.52	41.2	0.31	12	10		171.50	5.53	47
Kuala Trengganu, Trengganu	82.0	71.5	76.7	84	68	77	75	78.9	80.5	3.24	87.8	0.34	20	18		167.40	5.40	45
HILL STATIONS																		
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	68.0	56.3	62.1	73	53	65	60			5.61	142.5	234	16	11	2	169.05	5.45	46
Cameron Highlands, Tanah Rata, Pahang 4750 ft	69.0	56.1	62.5	72	45	66	62	67.3	67.9	5.30	134.6	241	16	14	7	167.90	5.42	45
Fraser's Hill, Pahang 4268 ft	66.5	59.0	62.7	73	55	63	63	67.6	68.8	10.39	263.9	210	19	18	29	109.30	3.53	30

Compiled from Returns supplied by the Meteorological Branch, Malaya

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THE Malayan Agricultural Journal.

APRIL, 1932.

EDITORIAL.

Agricultural Enterprise.

During the period of prosperity in the rubber planting industry it was almost impossible to direct attention to the commercial possibilities of other crops in Malaya. Even the coconut industry existed mainly by reason of the capital already sunk in it, backed, it must be admitted, by a small band of enthusiasts who had faith in the crop. The plantation oil palm industry was in its infancy and capitalists were generally adverse to developing the industry which at that time had little data to demonstrate its possibilities. Other crops grown, such as pineapple and gambier, existed merely as catch crops for rubber, while the majority of the remaining crops were in the hands of small-holders.

These secondary crops were unable to hold out the promise of high profits such as those enjoyed by the investors in the rubber industry, and the country therefore lost the advantage which a wider range of crops would have given through periods of trade depression.

The change of fortune in the rubber industry early led to quickened interest in other crops suitable for cultivation in Malaya and which might prove remunerative.

It is perhaps unfortunate that this interest in other crops should coincide with a period when capitalists and investors are reluctant to embark on new agricultural projects until they are able to visualise more clearly a general trade revival. This cautiousness, however, irritating as it may be to those who are convinced of the future prospects of particular crops, may ultimately prove to be to the advantage of the country, because it will mean that any developments made or contemplated are put into effect only after an exhaustive survey of the financial and economic factors involved. It may therefore result in constructive enterprise which will be less liable to the collapse caused by unforeseen circumstances which has been the unhappy feature of many projects in the past.

In spite of the difficulties of development of land which are inseparable from the present trade depression, there has been an encouraging development of agriculture in Malaya in several directions. During the past three years, the area under oil palms has increased by 30,000 acres, pineapples by 10,000 acres, coffee by 2,000 acres, tea by 2,000 acres and tobacco by 1,400 acres.

These extensions may not appear great, but they represent a move in the right direction and we confidently anticipate further extensions of the areas planted with these and other crops.

In 1930, the Cameron Highlands Development Committee published a small guide book to the Cameron Highlands. This publication gives information of use to those who wish to inspect land in that region and particulars under which land will be alienated. The Highlands open up new possibilities for agricultural enterprise which capitalists and others have not been slow to recognise.

There is, however, a demand for any information available concerning the agricultural possibilities of the Highlands. To meet the demand, at least in part, we include in this number an article by Mr. B. Bunting on the agricultural possibilities of Cameron Highlands. This information may be supplemented by reference to an article published in Volume VIII, No. 1 of this Journal on "Agriculture at Cameron's Highlands", by the same author.

While it is not claimed that the information contained in the present article embraces the scope of agricultural development possible in this region, or that it deals exhaustively with the crops stated, it should lead the reader who is interested in this direction to review the pros and cons of each crop and to have the advantage of the experience gained by the Department at its experimental area at Tanah Rata, Cameron Highlands.

The area suitable for agricultural development is not confined to the present Cameron Highlands, as there is much land outside this area which is suitable for the cultivation of upland crops.

While on the subject of widening the scope of agricultural enterprise in Malaya, we would take this opportunity of urging, once more, the local consumption of Malayan produce where available. To take but two such products, we have had ample opportunity of testing both tea and coffee locally produced and consider them excellent. Local enterprise has placed these products in our retail market and we would suggest that readers might give them a trial before again purchasing imported tea or coffee.

Rubber Seed and its Oil.

At least two attempts have been made in recent years to convert to commercial use the annual crop of rubber seed produced in Malaya.

On the face of it, it would appear reasonable to suppose that such a venture has a chance of success in view of the fact that the seed is a by-product of the industry, at present neglected except for the very small demand for seed for planting purposes. The only expenses involved are in the collection and transport of the seed to factory and cost of expressing and marketing the oil.

We believe that the first venture failed largely on account of unsuitable machinery and consequent deterioration of the seed before it could be treated. The second attempt involved the shipment of the seed to the Netherlands Indies before treatment. While we have no precise information on the causes of the

cessation of this enterprise, it is not unlikely that the seed was found to have deteriorated before it could be dealt with on arrival.

The period of seed production is a very short one, which involves a choice of the mill being able to preserve the seed in order to keep the plant working regularly, or to mill rubber seed during its season and to have other seeds to mill during the period when no rubber seed is available.

It is probable that the amount of rubber seed produced in Malaya approximates to 250,000 tons, a potential source of about 60,000 tons of oil. The increasing practice of cultivating cover crops with rubber, and of selective weeding, precludes such areas for the collection of seed, but there must still remain considerable areas where seed collection would be possible.

The authors of the article in the present number of this Journal record the results of their experiments designed to determine the nature of the deterioration of stored rubber seeds and possible methods of preserving the seed so that it may be available as the mill requires it. They also record the characteristics of the oil and of the resultant meal and conclude with remarks on the industrial possibilities of the oil.

The conclusion arrived at by the authors is that the seed must be collected at frequent intervals. Under good conditions of storage, it will keep for about four months after which time there is a rapid increase of acidity in the oil. If the kernels are stored under conditions that allow of no increase in humidity, the oil shows no tendency to increase in acidity.

It is concluded that only seasonal milling of the kernels would be likely to be profitable, the collection and treatment of a supply of kernels sufficient to keep even a small mill working during the whole year being out of the question. The possibility of establishing rubber seed oil on the vegetable oil market depends on the price of linseed oil, so that as long as the latter oil, with its markedly superior drying properties, is available at a cheap price, it is unlikely that rubber seed oil, with its limitations as regards collection of seed and treatment of kernels, will become a market commodity.

Pineapple Bran.

Yet another possible by-product of a local industry receives consideration in an article on "The Preparation and Disposal of Pineapple Bran," which has been prepared at our request by the British Consul at Honolulu to whom we tender our thanks.

The pineapple factories in Malaya are frequently much embarrassed on account of the accumulation of enormous quantities of waste pineapple material, the retention near the factories of which must be considered unhygienic, while its disposal in some instances involves considerable expense.

The preparation of pineapple bran from this waste has been developed by the Hawaiian packers. It offers at least a partial solution to this problem, although it must be remembered that, even in Hawaii, there is a present difficulty in disposing of all the bran, due probably not only to the general trade condition, but also to the rapid increase in production.

The Malayan packer would be well advised to consider the possible market for the bran before embarking on a considerable outlay of machinery for its preparation.

The quantity of live stock in Malaya is not large and a suitable concentrated food is already produced locally in "poonac", the residual cake from the extraction of oil from copra. A large production of pineapple bran might well injure this established local production of poonac, in which case the country would not benefit in any way by the introduction of a locally prepared pineapple bran.

Nevertheless, the disposal of pineapple waste remains a problem which might be solved by its conversion to pineapple bran.

Another possible method of disposal of pineapple waste is as a manure for pineapple cultivation. We are prompted to throw out this suggestion as results show that, except on virgin land, pineapples cannot be grown successfully in Malaya without the application of manure.

This possible solution has much to recommend it. The waste has first to be reduced to a suitable form. This subject has already been investigated by this Department and the results published in Vol XV of this Journal under the title: "Bye-products of the Pineapple Canning Industry." As pineapple factories are generally in the vicinity of the source of supply, transport costs should not be excessive.

Doubtless the last has not been heard on the subject of disposal of pineapple waste, but there is now considerable data available upon which a policy may be constructed.

Original Articles.

AGRICULTURAL POSSIBILITIES OF CAMERON HIGHLANDS FOR THE PROPRIETARY PLANTER AND SMALL-HOLDER

BY

B. BUNTING,
Agriculturist.

Introductory.

With the completion of the road from Tapah to Cameron Highlands considerable interest is now being evinced regarding the agricultural possibilities of the Highlands, principally from the point of view of the proprietary planter and small-holder.

In January, 1926 the Department of Agriculture commenced work on the opening up of an experimental plantation at Tanah Rata. Although good progress has been made in connection with the development of this plantation, the work was severely handicapped in the early stages owing to the absence of communications, but in spite of this, it has shown that a number of crops can be grown with success on the Highlands.

Situation.

Cameron Highlands proper comprises a comparatively small tract of country lying in the extreme north-west corner of Pahang situated at an elevation of 4,600 to 5,200 feet, which is bounded on the east and north respectively by the States of Perak and Kelantan.

The Highlands are approached by road from Tapah *via* Jor, Renglet and Lubok Tamang, the distance from Tapah to Tanah Rata being approximately 40 miles.

Tanah Rata, which is the southernmost part of the Highlands proper, is situated at latitude 4° 28" North and longitude 101° 23" East.

Topography.

The general lie of the country is naturally hilly, but there are numerous small portions of undulating land scattered throughout the Highlands which may be found suitable for the cultivation of annual crops. There is very little flat land to be found on either the Southern or Northern Highlands.

After leaving Tapah the road follows the Batang Padang valley and from about the 4th. mile ascends steadily until the Perak-Pahang boundary is crossed at 3,700 feet. The road from this point descends into Renglet and passes through an undulating strip of country known as Lubok Tamang (3,250 feet) until it

reaches Kuala Habu. At this point the road begins to rise again until it reaches the 37th. mile, (4,750 feet) and then falls to about 4,600 feet at Tanah Rata.

Climate.

The following is a brief summary of the meteorological readings taken at Tanah Rata (4,640 feet) for the period 1924 - 1931, which will give a good indication of the climatological characteristics prevailing on the Highlands.

Temperatures.—The mean maximum air temperature is 72°F. (highest mean maximum 74° and lowest mean maximum 70°), while the mean minimum is 56° (highest mean minimum 59° and lowest mean minimum 55°). The warmest day was 79° in April and the coldest night 42° in both January and February, while the coldest day was 63° in October, November and December and the warmest night 68° in April.

Although the seasonal changes of temperature are small they are greater than any found on the plains and the average daily maximum temperature is found to be lowest from October to February. The night minimum is, however, much the same throughout the year with a difference of only 4° between the highest and lowest mean minimum.

Rainfall—The average rainfall for the year over the period under review was 107.8 inches, the wettest month being October with an average precipitation of 13.7 inches and the driest month July with 4.1 inches. The greatest rainfall in a day was 6.3 inches, which was recorded in December, 1926 during the notorious floods in Pahang. It will be seen from these figures that the rainfall is somewhat low compared with other Hill Stations in the country, which is a decided advantage from an agricultural standpoint. The period September/December comprises the wettest months of the year, while there are marked dry intervals during January/March and June/July, which is much the same as on the plains.

Sunshine.—The average daily total of bright sunshine is 4.38 hours. The brightest month is July with 5.45 hours of sunshine per day and the dullest month is December with an average of only 3.32 hours per day. Although the sunshine is fairly evenly distributed the longest days' sunshine occur in the middle part of the year.

Experimental Plantation.

The Government Experimental Plantation at Tanah Rata is situated at the extreme South-east corner of the Highlands at an average elevation of 4,750 feet. The low-lying portion adjoining the Sungei Bertam is about 4,640 feet, while the highest areas cleared for planting is approximately 4,850 feet above sea-level.

The Plantation is sheltered by the surrounding mountain ridges, which include Gunong Berembun (6,036 feet) on the eastern side and Bukit Mentigi (5,120 feet) on the western side with Gunong Jasar (5,565 feet) and Gunong Ruil (5,680 feet) situated more distant in north-westerly direction.

As previously stated, work on the opening up of the Experimental Plantation

at Tanah Rata was commenced in January, 1926, at which time there were only about 12 miles of road leading up to the Highlands from Tapah.

The opened area of the Plantation is approximately 200 acres, but only about half this area has been planted up so far. It is the policy to open up the land on the Highlands a year or so ahead of requirements so as to allow of the removal of all valuable timber and at the same time economise on clearing and burning the partially dried stumps.

An area of about 100 acres has been planted up with tea, coffee, cinchona, cardamoms and numerous other crops which are likely to prove suitable for cultivation under the conditions obtaining on the Highlands.

At present there are about 40 acres under various jats of tea and a small tea factory has now being erected on the Plantation so that experiments may be carried out in the manufacture of upland tea.

Arrangements have also recently been made for a fully-trained Agricultural Officer to be stationed on the Highlands so as to be able to advise on the many agricultural problems which are likely to arise in connection with the future development of the Highlands. Mr. E. A. Curtler, Assistant Agriculturist, who visited Ceylon, India and Assam on a six months' tour to investigate agricultural conditions in those countries, has recently taken up his appointment and is now resident on the Experimental Plantation at Tanah Rata.

Visitors to the Highlands who are interested in agricultural matters are invited to inspect the Plantation by arrangement with the resident Agricultural Officer in charge.

Agricultural Possibilities on the Highlands.

In making a survey of the agricultural possibilities of the Highlands one must consider the suitability of the soil and climate for a particular crop in addition to finding a ready and profitable market for the produce when the crop matures.

The following is a brief summary of the crops which are under trial at the Experimental Plantation, Cameron Highlands and have so far shown promising results on a small experimental scale.

Tea.

There are at present about 40 acres planted with different jats of tea introduced from Assam and the growth to date has been most promising. The greater portion of this area was planted in 1928 so is only just coming into bearing.

The original area of Assam and Manipuri tea (Dangri, Dhonjan and Rajghur "jats") planted in January, 1926 with one-year old stumps continues to make excellent growth and is giving good yields. This area comprises about 430 bushes planted 4 ft. x 4 ft., which gives 2,722 plants per acre. Plucking commenced on the 27th. July, 1927, i.e. 2½ years from sowing the seed, and the calculated yields of dry tea per acre were 470 lbs. for the first plucking year with a plucking

round of 9 to 10 day intervals. Subsequent records indicate that a yield of over 600 lbs. of dry tea per acre may be expected under normal conditions.

Although samples of hand-made tea have been submitted for examination and favourably reported on in most cases, it will not be possible to ascertain the true quality of the tea until it has been manufactured under properly controlled conditions in the experimental tea factory now in course of erection at the Plantation.

The prospects for tea cultivation on the Highlands are distinctly promising as both soil and climate appear suitable for the production of upland tea for export, apart from satisfying the local demand for good quality tea.

The only drawback is that the cultivation of tea requires a large capital outlay and would require an area of at least 150 acres to warrant the erection of a small factory for the preparation of first-class tea. This difficulty might, however, be overcome to a certain extent by planting up contiguous small areas of 100 acres or more and arranging for the tea to be manufactured in a central factory under properly supervised conditions.

Arabian Coffee.

A small consignment of seed of Kent's Arabian coffee was received from the Department of Agriculture, Mysore in February, 1928. The seedlings raised from this consignment of seed were planted out in the field during the early part of May, 1928, and an area of 6 acres was eventually established at different distances of planting. These bushes commenced flowering at about two years after planting and produced the first crop of fruit a year later.

The beans produced have the typical bluish green colour of mountain coffee, when freshly roasted and ground the prepared coffee possesses a fine aroma and excellent flavour which leaves little doubt as to its high quality.

Unfortunately the area has recently been infected with coffee leaf disease, *Hemileia vastatrix*, so that further observation and experiment is necessary before coffee growing can confidently be recommended on the Highlands.

Cinchona.

A small quantity of seed of both *Cinchona Ledgeriana* and *C. succirubra* was received from Java in October, 1926. This was sown in carefully prepared seedbeds on the 18th. November. Germination commenced on the 9th. December, 1926 and ended in March, 1927. At the end of that month the germinated seedlings were transferred from the seed beds to nursery beds. These seedlings were again transplanted in September, 1927 being spaced 6 inches apart in the nursery beds, which were lightly shaded with bracken.

During October/November, 1929 a large number of the seedlings were planted 4 feet apart on terraces, the vertical interval between the terraces being roughly 7 feet, while the *Ledgeriana* seedlings were planted 4 feet x 4 feet on unterraced land. At the present time there are approximately 2½ acres of each species planted in the open. In addition there is about 1 acre of each type planted on

thinned out jungle to test the effect of shade on cinchona.

Samples of bark of both species taken from trees only three years old were sent to the Government Quinine Factory, Bengal, India for examination in June, 1930 and were very favourably reported on considering the trees are not yet fully developed.

The following figures show the analytical results of the samples in question :—

		<i>C. Ledgeriana</i>	<i>C. Succirubra.</i>
Quinine sulphate	...	10.53 per cent.	2.51 per cent.
Total alkaloids	...	9.40 "	7.31 "

The Government Quinologist in reporting on these samples stated "the quality is extremely high, but the bark most remarkably thin".

Although the preliminary results obtained with the cultivation of cinchona on the Highlands are distinctly encouraging, the extraction of the alkaloids from the bark and their subsequent purification would require a large outlay of capital so that cinchona is not a crop suitable for the proprietary planter with only a limited amount of capital at his disposal. Further, an area of a few hundred acres would be more than sufficient to supply the requirements of this country and it would be difficult to find an export market for any surplus produce owing to present over-production of quinine in Java.

Cardamoms.

The Department obtained a small supply of seed of both the Mysore and Malabar varieties of cardamoms from Ceylon during March, 1928 and both these varieties have been established. The planted area has been extended to about 4 acres with suckers obtained from the original Malabar plants. The plants of the Mysore variety have just reached the fruiting stage and judging by their behaviour to date, the cultivation of this crop may be attended with success, particularly at lower elevations in the sheltered valley of the Sungei Renglet and its tributaries (3,500 feet).

Fruits.

The climate and elevation of the Highlands are unsuitable for the successful cultivation of most temperate fruits.

A certain amount of success has been attained with a variety of strawberry introduced from the Philippines, although the fruits are somewhat small compared with the European varieties. Passion fruit flowers well on the Highlands and produces large quantities of fruit.

The thick-skinned citron also thrives exceedingly well at this elevation and fruits most freely all the year round. Other citrus fruits under trial include the orange, grape-fruit and the pomelo, but the trees are not yet sufficiently developed to produce fruit.

Rhubarb has also been successfully established from seed and appears to thrive on the Highlands.

Vegetables.

Excellent results have been obtained in the cultivation of vegetables, more especially at Renglet, where the soil conditions are probably more suitable.

The following vegetables have been grown from time to time with success :— lettuce, radish, green pea, beans, cabbage, cauliflower, carrot, beetroot, khol-rabi, turnip, Jerusalem artichoke, potato, leek, onion and tomato.

The demand for such vegetables on the Highlands will naturally be very limited until this Hill Station is more developed so that some other means will have to be found for the disposal of the produce. There may be a certain demand in some of the large towns such as Kuala Lumpur, Ipoh and Seremban, but the principal market would undoubtedly be Singapore, where the requirements of the shipping trade could be met to a certain extent.

There will always be some difficulty in disposing of the more perishable vegetables, such as lettuce, radish, leeks, beans, etc., as they very soon become unsaleable and therefore demand a ready market. The less perishable vegetables, such as carrot, turnip, beetroot, potato and possibly cabbage would, however, withstand long distance transport much better and at the same time would not require to be disposed of so quickly.

The cultivation of potatoes appears to hold out the best prospects under this heading, but they would have to be grown in rotation with other annual crops to be successful.

Further, it should be stated that continuous and heavy rains at critical stages in the growth of vegetables is ruinous to the crop and in order to maintain regular supplies a certain amount of protection by glass frames will be necessary.

Ornamental Plants.

Numerous flowers, shrubs and ornamental trees have been grown at the Experimental Plantation with excellent results.

Most flowering annuals thrive well on the Highlands and several species of bulbous plants such as *Agapanthes*, *Crinum*, *Watsonias*, *Moraeas* and *Montbretias* are growing and flowering freely.

Roses are a great success and most satisfactory results have been obtained with imported plants of named varieties.

Several types of ornamental trees have been under trial and amongst those which thrive particularly well are *Cryptomeria japonica*, *Cupressus macrocarpa*, *C. knightiana*, *Grevillea robusta*, *Casuarina* spp. and *Pinus merkusii*.

A market might be found in the large towns for cut flowers, more particularly in Singapore, where fair quantities of flowers are imported from Java, and this demand could easily be met from the Highlands if necessary. Little or no demand for cut flowers can be expected from the Highlands, even when it becomes more developed, since the residents will easily produce sufficient for their own requirements.

Dairy Farming.

The keeping of cows for the production of milk offers certain possibilities, but owing to the steep nature of the land, grazing on a large scale would be impracticable. This difficulty could, however, be overcome to some extent by stall-feeding the animals with Guinea grass, which thrives exceptionally well on the Highlands and suitable pasture grass would probably be provided by Australian Blue Couch where grazing on a small scale is possible.

The breeding of milch cattle for distribution on the plains might be worthy of consideration in case the production of milk on a small scale was not found sufficiently remunerative.

Poultry.

The breeding and rearing of poultry would appear to offer distinct possibilities if conducted on proper lines and good types of pure-bred fowls were kept. Rhode Island Red and White Leghorn would be suitable breeds for egg production, while Light Sussex are good layers and provide a good type of table fowl, especially if caponised and properly fattened.

Poultry keeping is, however, a subject which requires special study and unless previous practical experience has been gained in this direction it is most desirable to start in a small way until the numerous difficulties have been successfully overcome.

The demand for fresh eggs and properly fattened table fowls, if sold at reasonable prices, should make this a profitable undertaking apart from the sale of pure-bred stock for breeding purposes.

Marketing.

The greatest problem of the proprietary planter and small-holder will be the marketing of his produce. The cost of transport and distribution charges, unless reduced to an absolute minimum, are likely to make all the difference between profit and loss on the sale of produce.

The present rate of transport on the Highlands is 25 cents per ton per mile for a full load so that the rate would be proportionately higher for part of a load. This difficulty might be overcome to a certain extent by several small-holders co-operating with a view to providing (a) their own means of transport and (b) a selling or distributing agent for the disposal of their produce.

Attention would also have to be given to the grading and packing of produce so that standard orders could be placed by the distributors. For instance, if a case of potatoes was ordered it would be implied that it meant 120 lbs. or whatever standard was adopted for the packing of this particular produce.

These may appear to be minor considerations, but it will require really good organisation to dispose of produce at profitable rates with the least possible delay, otherwise it may become unsaleable and have to be destroyed.

Terms of Alienation.**Annex. 'A'.**

Lipis 203/31 : Phg. G. 241/31.

Annexure "A"

**Terms of alienation of Building Lands in the
Northern Highlands.**

Premium :

\$500 per acre or part of an acre;

Annual Rent :

\$5 per acre.

Form of Title :

Lease for 99 years.

Express Conditions :

(i) The lessee shall submit plans with elevations sections and specifications of a detached dwelling house with all necessary offices out buildings sewers and drains to the Chairman, Sanitary Board, Cameron Highlands within 6 months from the date of occupation or of registration of title whichever is the earlier. Such plans shall be subject to the approval and signature of the Director of Public Works or an officer authorised thereto by the Resident before the commencement of any works upon the land hereby leased Building operations shall not be commenced until such plans shall have been so approved.

(ii) The lessee shall erect upon the land hereby leased in a substantial and workmanlike manner with the best materials of their several kinds and in accordance with the plans elevations sections and specifications approved as aforesaid under the inspection of and to the satisfaction of the Director of Public Works or an officer authorised thereto by the Resident a detached dwelling house with all necessary offices out buildings sewers and drains and shall complete the same in all respects fit for occupation within 2 years from the date of occupation or of registration of title whichever is the earlier.

(iii) The lessee shall not make any alterations to any buildings at any time existing on the land hereby leased except in accordance with plans elevations section and specifications previously approved by the Director of Public Works or an officer authorised thereto by the Resident.

(iv) The lessee shall not erect or build or permit to be erected or built on the land hereby leased any buildings other than those specified in clauses (i) and (ii) above except in accordance with plans elevations sections and specifications previously approved by the Director of Public Works or an officer authorised thereto by the Resident.

(v) — — — — — .

(vi) The lessee shall pay to the State a reasonable proportion of the expenses of making repairing maintaining and cleansing all drains used in common by the land hereby leased and other land adjoining or near thereto, the amount

so to be paid to be determined by the Director of Public Works or an officer authorised thereto by the Resident.

(vii) The lessee shall not without the consent in writing of the Resident use or permit the use of the said house or any other buildings that may during the said term be erected on the land hereby leased for the purpose of carrying on any trade or business or any purpose other than as a dwelling house.

Annex. 'B'.

AGRICULTURAL TERMS.

GRANT.

Terms of alienation of lands for agriculture (excluding lands to be used solely for stock raising dairy farming and or the cultivation of vegetables and cattle fodder) in the Southern Highlands.

Premium :

\$35/- per acre.

Annual Rent :

\$1/- per acre for the first six years, and thereafter \$4/- per acre.

Form of Title :

Grant in perpetuity.

Implied Conditions :

In according with section 36 of the Land Code, 1926.

Express Conditions :

(i) The land shall be used solely for the cultivation of tea, coffee, cinchona, cardamoms, for stock raising and dairying purposes and for the cultivation of food-stuffs to be approved by the District Officer for human consumption or for consumption by cattle or for any one or more of the said purposes, or for any further purpose or purposes which may be approved by the Resident by endorsement on the Grant

(ii) Plans of all proposed structures on this land shall be submitted to the District Officer for approval prior to erection.

(iii) For the checking of soil scour the registered proprietor shall, to the satisfaction of the District Officer, construct and maintain upon the land hereby granted silt pits or contour terraces, and shall, if so required by the District Officer, plant and maintain cover crops for the same purpose.

(iv) The registered proprietor or proprietors will upon being called upon so to do execute a surrender to Government of so much land not exceeding 5% of the whole area hereof as may be required for the following purpose :—

Construction thereon of a public road, and the Government will after the registration of such surrender pay to the registered proprietor or proprietors compensation for disturbance or damage to improvements buildings or cultivated ground, resulting from such surrender.

The right to re-entry and forfeiture arising under section 37 of the land Code 1926 shall when it arises from breach of the foregoing condition be restricted so that no land in excess of 5% of the total area shall be liable to forfeiture.

Annex. 'C'.**SHORT TERM LEASE.**

Terms of alienation of lands to be used solely for stock raising dairy farming and/or the cultivation of vegetables and cattle fodder.

Premium :

\$2/- per acre.

Annual Rent :

\$2/- per acre.

Forms of Title :

Lease for 15 years with the right of renewal if the conditions have been carried out to the satisfaction of the Resident with increased premium, and rent on renewal should the Resident see fit.

Implied Conditions :

In accordance with section 36 of the Land Code, 1926

Express Conditions :

The land shall be used solely for one or more of the following purposes :—

Stock-raising.

Dairy-farming.

The cultivation of such food-stuffs for human consumption as may be approved by the District Officer. The cultivation of such food-stuffs for the consumption by cattle as may be approved by the District Officer.

(ii) Plans of all proposed structures on this land shall be submitted to the District Officer for approval prior to erection.

(iii) For the checking of soil scour the registered proprietor shall to the satisfaction of the District Officer construct and maintain upon the land hereby granted silt pits or contour terraces, and shall, if so required by the District Officer, plant and maintain cover crops for the same purpose.

(iv) The registered proprietor or proprietors will upon being called upon so to do execute a surrender to Government of so much land not exceeding 5% of the whole area hereof as may be required for the following purpose :—

Construction thereon of a public road and the Government will after the registration of such surrender pay to the registered proprietor or proprietors compensation for disturbance or damage to improvements buildings or cultivated ground, resulting from such surrender.

The right to re-entry and forfeiture arising under section 37 of the Land Code 1926 shall when it arises from breach of the fore-going condition be restricted so that no land in excess of 5% of the total area hereof shall be liable to forfeiture.

STORAGE OF RUBBER SEEDS

BY

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Introductory.

The present article summarises the results of an investigation carried out during the past two years to determine the treatment to which rubber seeds should be subjected in order to preserve them, since it is well-known that the untreated seeds deteriorate rapidly on storage with a considerable development of acidity in the oil.

Storage is necessary on account of the seasonal nature of the harvest, the greater proportion of the crop falling within a short period, usually during the months of September and October. The secondary fall which occurs at the commencement of the wintering season, January—February, is unimportant, compared with the main crop.

Further, it is immaterial whether the nuts are being exported or expressed locally. In the former case the time taken in transit to port of destination may be regarded as a period of storage, while for a local oil mill, relying upon rubber seeds, it would certainly be necessary from the point of view of economical working to arrange for a year's supply of seed. The seasonal milling of rubber seeds would only be profitable, provided they could be alternated with other oil-bearing seeds.

With regard to the utilisation of rubber seeds both the oil and cake have potential commercial values. Rubber seed oil, which belongs to the same class as linseed oil, possesses drying properties and can be used, for example, in the preparation of paints, while it has been shown that the cake remaining after expression of the oil forms a valuable feeding-stuff for cattle.

Although belonging to the same class as linseed oil, rubber seed oil is definitely inferior in drying properties, so that it is unlikely to replace that oil to any extent, unless the price of linseed oil is high. There are, however, other uses to which drying oils may be put and in which, for example, an inferior drying oil, such as rubber seed oil, might be preferable. There is little doubt, therefore, that, provided high quality oil could be produced in large quantities at a suitable price, rubber seeds would become established as a market commodity.

Composition of Seed.

The rubber seed consists of approximately 40 per cent. of shell and 60 per cent. of kernel, the variations found in the proportions of these two constituents

being dependent on the freshness of the seed. For example, in the freshly-fallen seed when the moisture content of the kernel may be as high as 35 per cent., the proportions approximate to 37 per cent. of shell to 63 per cent. of kernel, although for seed, which has been allowed to dry for a few days, there is a higher proportion of shell, consequent upon the more rapid drying of the kernel.

The following table gives the results of analysis of a sample of partially dried seed taken during the preparation of the samples for storage.

<i>Seed</i>		per cent.
Proportion of shell	...	42.4
Proportion of kernel	...	57.6
		100.0
<i>Kernel</i>		
Moisture (loss at 100°C.)	...	14.7
Oil (petroleum ether extract)	...	44.6
Residue (by difference)	...	40.7
		100.0
Oil (calculated on moisture-free basis)	...	52.3
Oil (calculated on seed)	...	25.7
Acidity of oil (calculated as oleic acid)	...	0.8

Consideration of Results of Analysis.

The results of analysis indicate that decortication is advisable on account of the large proportion of shell, the kernels occupying considerably less space than the seeds.

The high moisture content of the kernel necessitates drying in order to prevent increase in acidity of the oil as a result of the development of mould consequent upon the storage of moist oily material.

The oil content of the kernels is relatively high. The figure, calculated on a moisture-free basis, is slightly in excess of 50 per cent., which corresponds to approximately 25 per cent. on the seed.

Rubber seed kernels compare favourably as regards oil content with other well-known oil seeds, for example, palm kernels, groundnuts or gingelly, in all of which the figure for the oil content is of a similar order.

Although the acidity of the oil is low, being slightly less than 1 per cent., calculated as oleic acid, other experimental pressings carried out with freshly-gathered seeds have yielded oils with acidities less than 0.5 per cent. This indicates that the oil in the freshly-fallen seed is practically neutral.

It may be mentioned here that there is associated with the kernel an enzyme or non-organised ferment, which, owing to its power of splitting the oil into

glycerine and free fatty acids, is responsible to a certain extent for the increase of acidity in the oil of stored untreated kernels.

In addition to the enzyme the kernel also contains a cyanogenetic glucoside, that is a compound, which decomposes either as a result of enzyme action or in a very slightly acid medium yielding hydrocyanic acid (prussic acid) as one of the products. The faint smell of this acid noticed with moist fresh kernels, especially when they are heated, is evidence of the presence of this compound.

The hydrocyanic acid content of the kernels diminishes rapidly during the first week of storage as the figures in the following table, Table I, show. After that period the decrease is much more gradual, the amount present appearing to be approximately proportionate to the moisture content of the material.

TABLE I
Hydrocyanic Acid Content of Rubber Seed Kernels.

Period of Storage.	Moisture Content.	Hydrocyanic Acid Content.	Hydrocyanic Acid Content. (calculated on moisture-free basis)
weeks	per cent.	per cent.	per cent.
Fresh	35.9	0.077	0.120
1	29.0	0.016	0.023
3	12.7	0.015	0.017
4	11.4	0.011	0.013
14	6.5	0.006	0.006
20	8.1	0.006	0.007

The amount of hydrocyanic acid in fresh kernels appears to vary within fairly wide limits, as much as 0.223 per cent., calculated on a moisture-free basis, having been recorded.

Outline of Experiments.

As far as oil seeds are concerned both enzyme action and excess of moisture favour the development of acidity, the first by reason of direct chemical action on the glycerides composing the oil, while the storage of moist oil seeds, especially under local conditions, results in mould growth, which in turn causes decomposition of the oil.

As explained previously, the rubber seed kernel contains an enzyme, while the moisture content of the fresh kernel is also high, so that when laying down the experiments the treatment was varied so as to study the effect of both these factors on the storage qualities of the kernels. In this connection it may be mentioned that kernels were used in all the experiments, the freshly-gathered seeds being first decorticated by hand.

Since enzyme action may be inhibited by sterilising the material, in those experiments in which it was necessary to eliminate deterioration owing to this

cause the kernels were first treated in a closed vessel with steam under pressure.

As regards drying this was effected in a few instances by exposure to the sun. In the majority of the experiments the kernels were heated in a hot-air drier at a temperature of approximately 40°C. in order to reduce the moisture content to the required figure. It is considered that artificial drying is preferable, especially if the seeds are being treated on a commercial scale. Even in the dry season sun-drying is unreliable, and further, since the main rubber seed harvest coincides with the advent of the long wet season the chances of satisfactory sun-drying on a large scale are rendered still more remote.

Approximately 7 lbs. of kernels were used in each experiment. The kernels were stored in small sacks either hung inside a wire cage or suspended from the roof of the Experimental Factory so as to prevent rats from attacking the material. The sacks were sterilised previously with high pressure steam in order to free them from any insect pests. Samples of the kernels were removed for testing from time to time in accordance with the programme for the particular experiment.

As will be seen later, the kernels were badly attacked by insects. The material was examined by the Government Entomologist, who reported the presence of two beetles, *Carpophilus* sp. and *Silvanus advena*. It is understood that both these beetles are found whenever seeds, especially soft oil seeds like rubber seeds, are stored for any length of time. The former beetle, *Carpophilus* sp., also occurs with copra, while *Silvanus advena* is often found in stored rice.

Since it was thought that part of the increase in acidity might be due to this cause, in the second series of experiments the additional precaution was taken of enclosing the sack inside a fine muslin bag in order to prevent insect attack.

On account of the tendency of the material to become mouldy, which in turn causes decomposition of the oil, in some experiments the kernels were cut in half in order to ascertain whether this tendency would be increased owing to exposure of the interior of the kernel. It will be realised that while unbroken kernels were used in the experiments, mechanical decortication is bound to result in a proportion of the kernels being damaged with consequent exposure of the flesh to the air.

In order to obviate the effect of varying conditions of atmospheric humidity on the kernels during storage, which might reasonably be expected to affect mould growth, arrangements were made with the Electrical Board for the storage of 4 sacks of kernels at Bungsar Power Station. The sacks were stored in a warm, dry place where the minimum temperature did not fall below (30°C.) 86°F., while the maximum approximated to (37°C.) 98.5°F. Under these conditions a gradual desiccation of the kernels occurred, since the minimum temperature was only slightly less than the maximum atmospheric temperature.

The figure for the acidity of the oil was taken as a criterion of the storage qualities of the kernels, determinations of acidity being carried out on the oil obtained by expression. Approximately 1 lb. of kernels was removed on each

occasion, crushed between rollers, the resultant meal being warmed and pressed in the small laboratory hand-press.

Details of Experiments.

(a) Untreated Kernels and Sterilised Kernels.

Sacks of untreated kernels and sterilised kernels were stored for a period of two months. The kernels were sterilised with steam at a pressure of 30 lbs. per square inch for a period of 15 minutes and dried in the air for one day before placing in the sacks.

At the conclusion of the period of storage the results of examination showed that in both cases the kernels were mouldy, inside and outside, while in addition they had been attacked by insects.

In the case of the untreated kernels the acidity of the oil, calculated as oleic acid, was found to be 26.8 per cent., while that from the sterilised kernels was 17.9 per cent.

The results of the experiments show therefore that untreated kernels developed acidity rapidly on storage, while sterilisation alone is insufficient to prevent such development.

The acidity of the oil from the sterilised kernels is much too great to allow of the oil being used for high grade commercial purposes.

(b) Sterilised and Dried Kernels.

(i) Owing to the unsatisfactory results obtained by sterilisation alone another series of experiments was carried out in which the kernels, after being sterilised with steam at a pressure of 30 lbs. per square inch for a period of 30 minutes, were sun-dried for one week before storage. The moisture content of the kernels was approximately 8 per cent. Samples of the stored kernels were taken for analysis at intervals of two months, the results being shown in the following table, Table II.

TABLE II
Sterilised and Dried Kernels (First Series).

Period of Storage. months	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
2	0.2	Free from mould. Few insects.
4	3.3	Mouldy outside, about 35 per cent. mouldy inside. Few insects.
6	21.2	Mouldy outside, about 65 per cent. mouldy inside. Badly attacked by insects.

The results of this series of experiments indicate that, provided the kernels are sterilised and dried, it is possible to store them for a period of approximately four months without any marked increase in the acidity of the oil.

The rapid increase in the acidity of the oil after four months' storage is remarkable and would appear to be due to a combination of mould growth and insect attack.

(ii) In view of the interesting results obtained, a further series of experiments was laid down both to confirm the remarkable increase in acidity of the oil after four months' storage, also to ascertain the extent to which the increase could be attributed to the action of moulds or insect attack.

The kernels were sterilised with steam at a pressure of 30 lbs. per square inch for a period of 30 minutes, after which they were dried in the hot-air cupboard for approximately 12 hours, until the moisture content had been reduced to approximately 6 per cent. In two instances the kernels were cut in half immediately after decortication in order to ascertain whether exposure of the interior of the kernel was also likely to increase the tendency to development of acidity.

Two sacks, containing whole kernels and half kernels respectively, were suspended from the roof of the Experimental Factory, while two other sacks, each enclosed in a muslin bag as previously mentioned to prevent insect attack, were stored in a cupboard.

In order to obtain a better indication of the rate of development of acidity samples of kernels were drawn for analysis at the end of every six weeks instead of every two months as in the first series of experiments.

Further, in order to ascertain the extent to which the moisture content of the kernel varied on storage, moisture determinations of the meal obtained prior to expression were also carried out.

The results of analysis are shown in Table III, page 170.

In general therefore it may be said that the results confirm those obtained in the original series regarding the rapid increase in acidity of the oil after approximately four months' storage.

It is considered that the increase in the moisture content of the kernel during the first twelve weeks of the experiment can be attributed to the wet weather prevailing during the last three months of the year, the period of storage having commenced during the second week of the month of September.

Also it will be noticed that with the drier weather prevailing during the month of January there is a distinct tendency for the moisture content of the material to diminish.

The figures for the moisture content of the kernels indicate therefore that the material is susceptible to changes in atmospheric humidity. Further, there is no doubt that an increase in the moisture content can be correlated with both increased mould development and insect attack, the latter being the more potent factor as far as acidity is concerned.

It is interesting to note that there is practically no difference between the storage qualities of whole kernels and half kernels.

TABLE III

Sterilised and Dried Kernels (Second Series).

Details of Storage	Period of Storage. weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	6.7	0.2	
	6	8.5	0.6	Few insects. Slight mould.
	12	7.6	2.4	Few insects. Slight mould.
	18	5.6	9.4	Badly attacked by insects. No mould.
Half kernels stored in sack.	24	8.1	18.9	Insect-ridden.
	Fresh	5.1	0.1	
	6	8.4	0.7	Few insects. Slight mould.
	12	8.5	2.8	Few insects. Slight mould.
Whole kernels stored in sack enclosed in muslin bag.	18	5.7	11.0	Badly attacked by insects. No mould.
	24	7.9	23.9	Insect-ridden.
	Fresh	6.0	0.2	
	6	9.0	0.7	Good condition.
Half kernels stored in sack enclosed in muslin bag.	12	9.3	1.6	Very few insects. Mouldy.
	18	7.7	10.6	Very few insects. Mouldy.
	24	7.1	12.9	Very few insects. Mouldy.
	Fresh	5.3	0.2	
Half kernels stored in sack enclosed in muslin bag.	6	8.7	0.6	Good condition.
	12	8.9	2.1	Very few insects. Mouldy.
	18	6.7	7.2	Few insects. Mouldy.
	24	7.4	12.7	Insects developing. Mouldy.

As regards the actual loss of material suffered during the period of storage, results show that insect attack is much more serious than mould development. Kernels stored in sacks in the Experimental Factory lost approximately 20 per cent. by weight of material, calculated on a moisture-free basis, while those stored in the cupboard only lost approximately 10 per cent.

It may be mentioned here that, although a few insects succeeded in entering the sacks through the folds of the muslin it is not considered that they were sufficient in number to invalidate the general conclusions stated above.

(iii) Since it was thought that the initial moisture content of the kernel might have an influence on the storage qualities, an additional series of experiments was laid down in which the moisture content was only reduced to approximately 8 per cent. The results were, however, similar to those given in (ii) above so that it is not considered necessary to furnish details.

(c) *Dried Kernels.*

On account of the additional expense involved in sterilisation, a further series of experiments was carried out to ascertain whether drying of the kernels was as efficacious as combined sterilisation and desiccation.

TABLE IV
Dried Kernels.

Details of Storage.	Period of Storage weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	3.9	0.1	Good condition. Insect attack commencing. Mouldy. Badly attacked by insects. Slight mould. Insect-ridden.
	6	8.8	1.4	
	12	9.7	4.5	
	18	6.1	16.3	
	24	6.3	24.3	
Half kernels stored in sack.	Fresh	5.1	0.2	Good condition. Insect attack commencing. Mouldy. Badly attacked by insects. Slight mould. Insect-ridden.
	6	8.7	1.5	
	12	9.1	3.6	
	18	5.0	14.8	
	24	6.0	29.4	
Whole kernels stored in sack enclosed in muslin bag.	Fresh	4.9	0.3	Good condition. Very few insects. Mouldy. Few insects. Mouldy. "
	6	8.6	1.4	
	12	10.7	3.6	
	18	7.3	10.0	
	24	6.4	17.3	
Half kernels stored in sack enclosed in muslin bag.	Fresh	4.2	0.2	Good condition. Very few insects. Mouldy. Few insects. Mouldy. Badly attacked by insects. Mouldy.
	6	8.6	1.3	
	12	9.3	2.5	
	18	6.9	9.4	
	24	6.5	21.2	

The decorticated kernels, whole and cut in half, were dried in the hot-air cupboard at a temperature of 40°C. until the moisture content of the material had been reduced to between 4 and 5 per cent.

The conditions of storage were similar to those described in the second series for sterilised and dried kernels, the results of the experiments being shown in Table IV, page 171.

The results of this series of experiments also confirm the rapid increase in acidity of the oil taking place after approximately four months' storage.

A similar tendency for the moisture content of the material to increase during the first half of the period of storage is also noticeable.

With regard to the first part of the period of storage, it will be seen that drying alone is not quite so effective as both sterilising and drying, the figures for the acidities of the oils in the various experiments being slightly higher than those in the corresponding series given previously.

The high figure for the acidity of the oil from the half-kernels in the last experiment was due to a defect in the muslin bag, which was not discovered until the bag was opened on the conclusion of the storage period.

(d) *Sterilised and Dried Kernels at Bungsar Power Station.*

Arrangements were made for the storage of 4 sacks of kernels at Bungsar Power Station under special conditions so as to obviate any effect due to varying conditions of atmospheric humidity.

TABLE V
Sterilised and Dried Kernels at Bungsar Power Station.

Details of Storage.	Period of Storage. weeks	Moisture Content of Kernel. (approx.) per cent.	Acidity of Oil. (calculated as oleic acid) per cent.	Condition of Kernels.
Whole kernels stored in sack.	Fresh	7.6	0.4	Good condition. Do. Do. Do
	6	3.1	0.4	
	12	4.1	0.3	
	18	3.2	0.3	
	24	3.3	1.0	
Half kernels stored in sack.	Fresh	6.7	0.4	Good condition. Do. Do. Do.
	6	2.9	0.5	
	12	3.8	0.2	
	18	3.2	0.2	
	24	3.2	0.6	
Whole kernels stored in sack enclosed in muslin bag.	Fresh	8.6	0.5	Good condition. Do. Do. Do.
	6	2.9	0.3	
	12	3.8	0.2	
	18	3.2	0.2	
	24	3.0	0.5	
Half kernels stored in sack enclosed in muslin bag.	Fresh	6.0	0.5	Good condition. Do. Do. Do.
	6	3.1	0.3	
	12	4.0	0.2	
	18	3.1	0.3	
	24	3.3	0.7	

The kernels were sterilised and dried to a moisture content of approximately 7 per cent. before storage, the details of the experiments being as given previously. The results are given in Table V, page 172.

The results of the experiments show that, provided the treated kernels are stored under conditions which do not allow of changes in atmospheric humidity affecting the material, the oil shows practically no tendency to increase in acidity, even after six months' storage.

It will be noticed that in only one instance the acidity of the oil has risen to 1 per cent. The irregular figures for acidity obtained in the early stages of the various experiments are only to be expected when estimating acidities of oil of such a low order expressed under factory conditions.

Characteristics of Rubber Seed Oil.

Although this article is concerned with investigations on the storage qualities of rubber seeds it is not considered out of place to refer briefly to the characteristics of the oil, especially as reference has already been made to its utilisation.

Rubber seed oil is light yellow in colour when freshly prepared and has an odour somewhat resembling linseed oil. A darker coloured oil is obtained from the stored seeds, while the oil itself darkens on keeping. In this connection it may be mentioned that, although the kernels when sterilised and dried darken slightly during such treatment, especially when sterilised with high pressure steam, the colour of the oil is scarcely affected.

The constants of the oil are shown in the following table, average figures for linseed oil being added for purposes of comparison:—

<i>Oil.</i>	Rubber Seed Oil	Linseed Oil (Average)
Specific gravity at 30°C (water at 15°C = 1)	0.9163	0.934 (15°C)
Refractive index at 30°C	1.4690	1.4758
Saponification value	194.2	192.0
Iodine value (Wijs)	137.1	170—190.
Acidity (oleic acid per cent.)	1.5	3.0 (maximum)
Unsaponifiable (per cent.)	1.0	1.5
<i>Fatty Acids.</i>		
Solidifying point (Titer value)	28.4°C	17°—24°C
Mean molecular weight	284.5	
Iodine value (Wijs)	139.4	

The results indicate that the normal acidity of linseed oil is low. If, therefore, rubber seed oil is to compete it would be necessary to take such precautions as to ensure an oil of similar quality. This would involve the treatment of the freshly collected seeds without delay.

The figure for the iodine value, which is regarded as a measure of the drying properties of the oil, shows the inferiority of rubber seed oil to linseed oil in these respects.

Rubber Seed Kernel Meal.

In view of the large number of experimental pressings carried out in connection with the preparation of the necessary samples of oil for acidity determinations, advantage was taken to analyse a sample of the solvent-extracted meal in order obtain analytical data for such material.

The results of analysis are shown in the following table, average figures for extracted linseed meal being added for purposes of comparison :—

	Rubber Seed Kernel Meal		Linseed Meal (Extracted)	
	per cent	Moisture-free basis per cent	per cent	Moisture-free basis per cent.
Moisture ...	11.0	—	10.2	—
Ash ...	4.7	5.3	6.8	7.6
Oil ...	—	—	3.8	4.2
Crude Protein ...	33.6	37.8	37.4	41.7
Crude Fibre ...	3.4	3.9	9.1	10.1
Carbohydrate (by difference)	47.3	53.0	32.7	36.4
	100.0	100.0	100.0	100.0
Phosphate as P_2O_5 ...	1.4	1.6	—	—
Potash as K_2O ...	2.1	2.3	—	—

The results of analysis show that rubber seed kernel meal is rich in crude protein, while it is low in crude fibre. As regards the crude protein content it will be seen that the meal approaches in composition to linseed meal, although the figure for the crude fibre is considerably less.

Experiments showed that the meal from stored kernels still contained a small amount of the cyanogenetic glucoside, to which reference has already been made. For example, in the meal from kernels stored for 18 weeks the amount of hydrocyanic acid was found to be of the order 0.01—0.02 per cent.

Rubber Seed Shells.

Assuming that the kernels were being dried artificially, supplies of fuel would be necessary, in which case there is no doubt that the shells obtained on decortication would be used.

An analysis was therefore made of the fresh shells in order to ascertain the value of the material from the point of view of plant nutrients, although it is realised that by burning the shells the whole of the nitrogen would be lost. The results are given in the following table :—

		per cent.	Moisture-free basis per cent.
Moisture	...	12.32	
Ash	...	0.33	0.38
Nitrogen	...	0.26	0.30
Phosphate as P_2O_5	...	0.004	0.005
Potash as K_2O	...	0.085	0.097.

The results of analysis show therefore that the fertilising value of the ash is not great. The percentage of ash is low, while the percentages of phosphate and potash in the ash are only 1.3 per cent. and 25.6 per cent respectively.

Remarks and Conclusions.

The results of the investigation show that in order to preserve rubber seeds against development of acidity in the oil the seeds should be collected frequently and treated without delay.

Frequent collection is essential, since the main harvest coincides with the arrival of the long wet season and if the seeds are left lying on the ground for any length of time during such weather there will be a marked increase in the acidity of the oil.

It is shown that under normal conditions of storage the kernels from freshly collected seeds after treatment can be preserved for a period of approximately four months without any marked increase in the acidity of the oil. Treatment of the kernels involves either combined sterilisation and drying or merely drying, the combined treatment giving slightly better results.

Partly on account of the soft texture of the kernel and partly on account of the changes in humidity, the material is liable both to mould development and insect attack. The results become marked after approximately four months, when there is such a considerable increase in the acidity as to render the oil unsuitable for high grade commercial purposes.

As a result of mould development and insect attack there is a considerable loss of material. With severe insect attack the amount may be as much as 20 per cent., but with mould development only 10 per cent. The oil content of the material does not appear to be markedly affected.

If the treated kernels are stored under conditions that do not allow of increase in humidity, the oil shows no tendency to develop acidity.

Possibilities of Rubber Seed Oil Production.

Although, with the abnormally low prices now prevailing for oil seeds there is no chance of any development as regards the utilisation of rubber seeds it must be remembered that the experiments were commenced two years ago when several enquiries were received regarding the possibilities of the oil. The following remarks must be taken therefore as applying to normal conditions.

Seed collection would have to be restricted to clean-weeded estates, since on account of the size of the seed it would be uneconomical to consider collection on any estate where there was a cover-crop.

From the point of view of local treatment, the results of the storage experiments indicate that only seasonal milling of the kernels would be likely to be profitable, the collection and treatment of a supply of kernels sufficient to keep even a small mill working during the whole year being out of the question.

The kernel store should be clean and well-ventilated so that in the relatively short period during which it is possible to store kernels without any marked increase in acidity of the oil the effects of mould development and insect attack may be reduced to a minimum. The rubber seed kernel with its soft texture would appear to be specially influenced by these two factors.

No comments can be offered on the possibilities of exporting the treated kernels in sacks, although there would appear no reason to expect any considerable increase in acidity during transit, provided the treatment had been adequate and sacks free from insects had been used for packing.

As stated previously, the possibility of establishing rubber seed oil on the vegetable oil market depends on the price of linseed oil so that as long as the latter oil, with its markedly superior drying properties, is available at a cheap price, it is unlikely that rubber seed oil with its limitations as regards collection of seed and treatment of kernels will become a market commodity.

In conclusion, the writers wish to thank the Chairman of the Electrical Board, F.M.S. and Mr. P. A. Bray, Superintendent, Rungsar Power Station, for their kindness in granting storage facilities.

AGRICULTURAL COMMODITY VALUES IN MALAYA 1931

BY

D. H. GRIST,
Agricultural Economist.

During the year 1931, Malaya experienced an unprecedented decline in the export values of the agricultural products upon which the prosperity of the country so largely depends.

The effect of this decline in prices was felt not only in the sale of the agricultural products of Malaya, but in the very considerable trade in the agricultural products of neighbouring countries which are shipped to Singapore in particular, where they are regraded and converted to a condition suitable for the world's markets.

The main agricultural exports of Malaya are rubber, coconut products, canned pineapples, tapioca, arecanuts, oil palm products, sago and hides and skins.

The production of rubber in Malaya 1931 is estimated at 434,857 tons, as compared with 435,063 tons in the previous year. The average unit value, however was 50 per cent. less than in 1930.

The net exports in 1931 of the remaining agricultural products stated above were 242,122 tons, being but 2,012 tons, or 1 per cent. less than the preceding year. The total value of the net exports of such products in 1931, judged on the declared trade values of imports and exports as published officially, was \$26,629,817, being \$10,856,645, or 29 per cent. less than in 1930. The details are given in the Table which follows:—

TABLE I.
Net quantity and Value of Principal Agricultural Exports of Malaya
1930 and 1931.
(Excluding rubber)

PRODUCT.	1930		1931	
	Quantity tons.	Value \$	Quantity tons.	Value \$
Coconut Products ...	121,965	18,073,789	121,186	11,558,325
Pineapples, Canned ...	57,960	7,859,048	59,457	7,083,450
Tapioca ...	31,195	2,988,419	28,257	2,163,170
Arecanuts ...	23,254	5,149,019	19,266	2,804,221
Oil Palm Products ...	3,696	973,787	5,300	1,121,703
Sago ...	2,013	1,040,633	5,133	801,730
Gambier ...	2,697	526,787	2,563	630,914
Hides and Skins ...	1,354	874,980	960	466,304
TOTAL ...	244,134	37,486,462	242,122	26,629,817

It is seen therefore, that the difficulties of the rubber industry are very similar to those of other agricultural industries of Malaya.

Whereas Malaya has maintained the volume of its agricultural export crops during 1931, the prices realised have declined by nearly one-third.

This drop in values has resulted in a smaller purchasing power of the inhabitants. The following figures of the decline in net imports of the principal foodstuffs illustrate this point :—meat, groundnuts, kachang oil, vegetables and sugar have each 10 per cent. decline in quantity; rice 13 per cent; milk, poultry, eggs, fruit, tea each 20 per cent.; livestock for food and coffee 23 per cent. This reduction in consumption is, of course, due in part to the closing down of many estates and tin mines and reduction of labour force on those at present operated, and the consequent repatriation of a large number of labourers to India and China.

The values of the net imports of foodstuffs have shown a decided drop in 1931 as compared with the previous year. As is shown in Table 2, these reductions exceed 40 per cent. for rice, meat, livestock, tea, coffee, groundnuts and kachang oil. For poultry, eggs, vegetables and fruits the reductions in values are between 30 to 40 per cent., while milk has dropped 21 per cent. and butter 16 per cent. The two latter products however, do not effect a large proportion of the community.

TABLE II.

Net Quantity and Value of Principal Foodstuffs Imported into Malaya in 1930 and 1931.

PRODUCT.	How Stated.	1930		1931	
		Quantity.	Value \$	Quantity.	Value \$
Rice and Padi ...	Tons	594,322	64,464,222	518,230	35,176,019
Livestock and Meat ...	Tons	—	10,320,833	—	6,054,613
Milk, butter, poultry, eggs ...	Tons	—	15,103,734	—	11,486,447
Vegetables ...	Tons	52,773	6,091,512	47,553	4,126,187
Fruits ...	Tons	19,948	3,757,745	16,053	2,510,520
Sugar ...	Tons	101,881	8,310,408	91,855	6,584,800
Groundnuts and kachang oil ...	Tons	21,131	5,020,786	20,098	3,650,423
Tea ...	Lbs.	8,732,453	2,872,220	6,848,642	1,667,931
Coffee ...	Lbs.	8,992,695	1,819,713	6,959,608	972,578
TOTAL ...		—	\$117,761,173	—	\$72,229,518

The net imports of the necessities of agriculture in Malaya, such as feeding stuffs for animals, fertilizers, rubber cases, agricultural implements and machinery all shew considerable reductions in quantity and an average decrease in value of over 40 per cent.

The luxury tobacco, the imports of which were well maintained during 1929 and 1930, exhibited a rapid fall in quantity (28 per cent.) and in value (39 per cent.) in 1931, in comparison with the year 1930.

A number of other agricultural (or closely allied) products are imported into Malaya, including charcoal and firewood, (the net imports of which were valued at just over a million dollars in 1931, a decrease of 27 per cent. as compared with the value of the imports in 1930) attaps, castor oil, kapok, patchouli leaves, coir cordage and fibre, mats and matting and flowers. These net imports were valued at \$1,630,000 a decrease of about \$300,000 from the corresponding imports of 1930.

From the above brief review of the exports of agricultural products and imports of foodstuffs it is concluded that the resulting greatly decreased purchasing power of the population has been met partly by a decrease in the cost to this country of necessary foodstuffs. Incidentally, the situation has been eased in some measure by good padi crops reaped in almost all padi-growing districts of Malaya, and by an increase in the production of locally grown foodstuffs. It is evident too, from the fact that the volume of exports has been maintained while the labour force for their production has been reduced by repatriation, that there has been stricter economy of labour. In view of the greater purchasing power of his money, the labourer in regular employment, although on a lower rate of pay, has been able to maintain himself and his family on a scale not very different from that obtaining before the present economic depression.

THE PREPARATION AND DISPOSAL OF PINEAPPLE BRAN.

*Forwarded to the Department of Overseas Trade by the British Consul
at Honolulu. September 1931.*

General.

Pineapple bran is the name now given to the by-product of the pineapple canning industry and has entirely replaced the earlier name of "dried pineapple waste" which connoted a residue of considerably less commercial prestige than the article itself enjoys. Its production on a commercial scale is of comparatively recent date and its use was at first practically limited to that of a fertilizer, but it was discovered by experience that this application of the product was not only uneconomical on account of the necessity of transporting it to the pineapple fields but was unsatisfactory on account of paucity of nitrogen and was in addition injurious to the soil owing to the high percentage of acid content. Furthermore its tendency to attract flies, beetles and various insects rendered it unsuitable as manure, and its use for this purpose has been almost entirely abandoned.

The demand which it enjoys as a stock feed continues, however, to grow, though as yet it has not been found possible to dispose of the entire production of the canning companies. The total amount of bran produced has risen from 1,726 tons in 1923, when production was first seriously undertaken on a commercial scale, to 10,916 tons in 1930, but it does not appear likely that there will be any appreciable change in the present season (1931). The increase in the pack from twelve to thirteen or fourteen million cases would suggest a corresponding, or even proportionately larger, increase in the amount of the by-products, particularly as a potential pack of sixteen million cases is being restricted, on account of over-production, by the rejection of all but first grade fruit, which implies that a larger proportion of the fruit which enters the canning factory must emerge in the form of bran. The fact, however, is that over-production applies also, though to a smaller extent, to the bran, of which some stocks remain over from last season, and it has therefore been found necessary to dump considerable quantities of the waste products of the canning process on unoccupied lands some miles outside Honolulu.

While the name bran can be considered an appropriate one as representing the dried shell or hull of the pineapple, the final product as used to-day is coarser in texture than ordinary brans or meals. In itself it is of low protein content and must be mixed with other materials such as corn, soya bean, wheat-bran, coconut meal, linseed-oil meal, etc. in order to make it suitable as a feed for livestock, and in this form it has achieved a market success.

The method, commonly employed, of mixing the bran with cane molasses, of which there is an abundant supply in these islands, is referred to on page 7 of a pamphlet entitled "Pineapple bran as a feed for Livestock", but one of the canning companies now produces a "molasses-bran" by mixing the molasses with the bran prior to the drying process, as described below. The major part of

this product is shipped to the continental United States, thus obviating the necessity of transporting the molasses separately, while the plain bran is consumed almost entirely in Hawaii. The advisability of using molasses at all with pineapple bran is apparently doubted in some export quarters for the reason that the bran itself is sufficiently rich in sugar, and the molasses contribute none of the proteins which it lacks and which must be applied to make it suitable as a stock feed.

The molasses bran retain to a slight degree the dark colour imparted to it by the molasses before the drying process.

Method of Preparation and Machinery Used.

The material used in the preparation of pineapple bran consists of waste skins, ends, cores, peelings and rejected slices accumulated in the canning process.

All of these unused portions run on conveyers into a *juice bath* which prevents any heavy foreign matter, such as for instance a small part of a machine which has accidentally become detached, from reaching the delicate shredders and presses at a later stage of the process. The lighter matter floats in the bath and is caught up by a series of inverted rakes fixed to an endless belt by which it is conveyed to a higher level and into the *mill* or *shredder*. This is a vertical machine, similar to that used in the crushing of beet and copra, and consists of a worm revolving about a vertical axis, the motive power being supplied by an individual motor fixed to the top of the mill. The juice which results from this and subsequent pressings is carefully collected and used in the preparation of by-products like citric acid and calcium citrate, whereas the juices which emerge in the initial stage of the process from the "Ginaca" or shelling and coring machine are clarified by centrifugal action, which rids them of fibrous matter, and utilised in the canning of the fruit, or are sold separately.

From the vertical mill the waste passes into a *press* which comprises two sections, *viz.* the first chamber in which are two toothed rollers in juxtaposition and geared so as to revolve at different rates about a horizontal axis the power being furnished by external dynamos, and the second chamber consisting of a worm and screen.

The resulting pulp is passed through the shredders and pressed a second, and in some cases even a third, time and is then conveyed to the *dryer*, which consists of a large cylindrical drum, revolved at the rate of about four revolutions a minute by external contact. In the earlier days of the preparation of pineapple bran one of the canning companies, which at the present time account for some 35 per cent. of the total pack, used a drying drum measuring 40 feet by 5 feet diameter, but their present drying equipment consists of two drums of 40 feet length and 8 feet diameter. The larger diameter facilitates internal repairs to the blades fixed to the inside walls of the cylinder at varying angles, so as to ensure the thorough mixing of the bran as the drum revolves. At the entrance end of the drum is a large oil burning furnace which supplies the combustion gases by which the bran is dried to a moisture content of about 9 per cent. When the bran has been

made sufficiently light it is automatically wafted by the combustion gases through the aperture at the end of the drum and is collected. Capacity varies with the amount of moisture present in the bran when it enters the drum. Approximately 10,000 lbs. of water are evaporated per hour.

The only modification in the process of preparing "molasses bran" is that a stream of molasses is allowed to fall on the pulp as it is being conveyed from the final pressing to the dryer.

Machinery: Manufacturers and Cost.

The machinery used in the process by the three large canning companies in Honolulu was designed for the particular requirements of each factory by Mr. Henry Schwartz of the Schwartz Engineering Company, 208, Mach Building, Denver, Colorado, U.S.A. The greater part of the machinery was manufactured by that company and the remainder under its supervision. The designs of the drying furnaces, for example, were prepared by Mr. Schwartz, though the furnaces themselves were made locally to the required specifications. The drums, however, were manufactured by the Schwartz Company.

The matter of the cost of the machinery is a difficult one, since price is entirely dependent on the requirements, and this naturally varies with the output per hour, the power available, housing accommodation etc. It is suggested that specifications and estimates should be procured from the Schwartz Company to suit individual requirements, since these are likely to differ very materially from those of the pineapple canning industry of this Territory, which accounts for about 95 per cent. of the world's production.

The preceding rough outline of the preparation of pineapple bran will perhaps have failed to convey a correct impression of the extensive character of the machinery used and of the space required to house it. In the canning factory of the Hawaiian Pineapple Company, which in 1930 packed nearly 105 million cans and produced something like nine million pounds of bran, the shredders and presses are in triplicate, and the drying drums and furnaces in duplicate. The shredders and presses are situated at a considerable altitude, while the drums are at ground level, so that a large amount of the available space in the factory is taken up by conveyors, shoots etc. and by the electrical machinery which supplies the power for the crushers and presses.

Some idea of the cost of the machinery in use in the model cannery of a highly developed concern like the Hawaiian Pineapple Company may be formed from the following figures:—

Vertical Mill	...	3,500 — 4,00	U.S. dollars.
Worm and screen press	...	10,000	do.
Motor and Drive for press	...	3,000 — 4,000	do.
Drying drum	...	40,000 — 50,000	do.

The Economics of the Preparation and Marketing of the Bran.

One important consideration in connection with the preparation of pineapple bran is that until recent years the disposal of the waste products of the canning industry involved the companies in considerable expense, since the refuse had to be burned, dumped into the sea or put back on the fields as fertilizer. Where, as in the case of Honolulu, the canneries are within the city limits, the cost of transportation—even for dumping—are heavy, and the initiation of a process for utilizing the refuse in the preparation of a saleable commodity has justified the outlay of elaborate and expensive machinery necessary to that end. It is estimated that only approximately 50 per cent. of the pineapple is suitable for canning, the remaining 50 per cent. consisting of the shell, core, trimmings and ends; and at time like the present, when production is being restricted by careful selection, the percentage of waste in one pineapple is much higher than 50 per cent.

The bran is packed in eight ounce jute bags of 100 pounds each and, as already explained, is absorbed almost entirely by the local market. The present selling price is \$17.00 per ton, f.o.b. factory, Honolulu, but it has in recent years fetched as high a price as \$24.00 per ton. One of the canning companies has recently contracted to supply as much as 75 tons per month to the Honolulu Dairymen's Association as a stock feed. Another company which in 1930 produced 100,000 bags of 100 lbs. each (say 4,500 tons) has already sold its 1931 output, which however is not expected to reach more than fifty or sixty thousand bags, large quantities of the waste having been thrown away during the season on account of excess production.

It was stated above that in 1930 the Hawaiian Pineapple Company produced 105 million cans of pineapple and in the same period the production of bran amounted to roughly 100,000 bags or 10,000,000 lbs.; so that, in the probably justifiable assumption that there was no effort to restrict production in that year, it follows that 1 lb. of bran results from the filling of 10 cans, or (very approximately of course) that about 10 pineapples produce, as a by-product, one pound of bran. In the present (1931) season enforced restrictions demand that only approximately half that amount of bran will be produced by the same number of the fruit.

Review.

Hydnocarpus Oils in Malaya.

By C. D. V. Georgi, O.B.E., B.Sc., F.I.C., T. A. Buckley, M.Sc., Ph.D., A.I.C.,
and Gunn Lay Teik, B.A., Department of Agriculture, S.S. and F.M.S.
Special Bulletin, Scientific Series No. 9. 18 pp. 1932.

Price 50 cents (Straits).

Since chaulmoogra and hydnocarpic oils, obtained from the seeds of *Taraktogenos* and *Hydnocarpus* have been applied to the treatment of leprosy, the cultivation of one species of *Taraktogenos*, *T. Kurzii* and two species of *Hydnocarpus*, *H. anthelmintica*, Pierre and *H. Wightiana*, Blume has been undertaken at the Government Experimental Plantation, Serdang, the two latter having now reached the bearing stage.

In the publication just issued, the authors record their results of the examination of samples of the seed from the point of view both of comparing the oil contents and of ascertaining the quality of the oil that can be obtained by treating the seeds on a commercial scale. The constants of the two oils were also determined and a partial examination made of the individual fatty acids present as glycerides in the oils.

The authors conclude that provided the fruits are harvested soon after they fall and the seeds are cleaned and dried without delay, the preparation of high quality oil on a commercial scale would present no difficulties. It is shewn that the oil content of the seeds of *H. Wightiana* is double that from *H. anthelmintica*. As a source of pure hydnocarpic acid, the oil from the former variety would be preferable, since after fractional distillation of the mixed ethyl esters the contaminating esters—that is, those other than hydnocarpic and chaulmoogric—are found associated with the latter ester, leaving the hydnocarpic ester in a relatively high state of purity. This is not the case, however, with the oil from *H. anthelmintica*.

From the point of view of yield and purity of oil, it would be preferable to plant *H. Wightiana*, provided that its cultivation is equally satisfactory.

These conclusions are of definite value in view of the increasing importance of these oils in medicine, which should result in a certain demand for a reliable source of supply.

D. H. G.

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

First Quarter, 1932

BY

G. H. CORBETT.

During the past two years the writer has endeavoured to incorporate in these quarterly notes interesting as well as important observations on insects which have been observed during the preceding three months. In publishing these notes there is the danger of placing before the public statements which may prove on further association with a problem to require modification. Entomological problems in Malaya as elsewhere are many and not the least is the agents responsible for causing and for terminating outbreaks of insects. Several insects can be named which are reported during the first few months of each year as inflicting severe and extensive damage to plants, and, in some cases, these reports are received from the same areas although the identical plant is generally cultivated throughout Malaya. Why for instance does *Setora nitens* Wlk.—a nettle caterpillar of coconuts—appear in enormous numbers about the same time every year, in one particular area of Malaya?. Why are *Amathusia phidippus* L. and *Hidari irava* Moore., both insects of coconuts, found each year in another area in considerable numbers? Why has *Psilopholis grandis* Cast. not been reported in Malaya causing damage to the roots of mature rubber trees in areas other than in an area of about 80 acres? The wide term climate undoubtedly in some ways plays its part. Unfortunately detailed observations are not available as to the time insects begin to increase. It is only when they are seen in enormous numbers that they are reported.

Regular weekly consignments of a few insects have been received during the past quarter and in the case of *Amathusia phidippus* L., Chalcid and Tachinid parasites from the pupae would undoubtedly appear to be responsible for the disappearance of this butterfly. Several well-known pests of gutta percha occur in Malaya and the caterpillars of *Stauropus lichenina* Butl. are particular prevalent during the early months of the year. At the time of writing the caterpillars of this Notodontid moth cannot be found but the consignment of eggs received in the first week of March was completely parasitised, indicating that egg parasites may be responsible for the disappearance of this pest.

The above two-named insects having been apparently subdued by parasites, the problem still remains what agents bring about their increase?.

Oil Palms

It is considered that the Rhinoceros beetle (*Oryctes rhinoceros* L.) prefers coconut to oil palms but this insect may become an important pest of oil palms if conditions are favourable. It is not, apparently, generally known that this beetle lays its eggs in decaying vegetable debris of almost every description.

Here the eggs hatch, the grubs feed and pupate and finally emerge as the familiar Rhinoceros beetle which bores into and feeds upon the young unfolding leaves.

During this quarter the writer was asked to visit an estate in order to discover the breeding places of this beetle. They were found in palm refuse around the factory, in heaps of palm fibre waste which had been deposited along the truck tracks and at places where the remains of bunches from which the fruit had been collected had accumulated.

Accumulations of this description should be scattered or disposed of in some suitable matter.

Rubber.

In "Entomological notes for the Fourth Quarter, 1931" reference was made to grubs damaging the roots of mature rubber. The beetle in question has recently been identified as *Psilopholis grandis* Cast. The two Scoliid parasites, not three, are *Campsomeris javana* Lep. and *Campsomeris pulchri-vestita* Cam. Both these parasites are numerous although large grubs of *Psilopholis* are now comparatively rare.

Both these parasites first lay hold of a mandible and sting a grub in the ventral thoracic region near the first and second segments. After stinging the grub effectively, they drag it to a suitable place with the ventral surface uppermost. The mandibles and the last abdominal segment play important parts in kneading the grub into proper shape. This operation having been completed, the ventral surface and spiracles are painted with what appears to be the sting. This painting process has occupied six minutes. Finally, walking forward with the head in juxta-position with the head of the grub, an egg is dropped which remains in an erect position.

The majority of eggs of both *C. javana* Lep. and *C. pulchri-vestita* Cam. are dropped mid-ventrally on the fourth abdominal segment. With both these species, the egg stage is about 3 days, the larval stage about 6—7 days and the cocoon stage 27—32 days.

Coconuts.

An unusual outbreak of the gelatine caterpillar of the Limacodid moth, *Chalcoscelis fumifera* Swinh., was reported in February over an area of some 100 acres of coconuts. Occasionally caterpillars of this moth have been collected but this is the first record of its occurrence in considerable numbers in Malaya.

The eggs are very difficult to see, the full-grown caterpillars are about 20—25 mm. in length, pale blue with whitish coloured markings and resemble convex lumps of jelly. The cocoon is round and whitish in colour.

The study of the insects of copra has been continued. Various attractants for the control of *Necrobia rufipes* de Geer. (the copra bug) have been tried. It would appear that valerianic attracts this beetle in greater numbers than oleic acid and that the mixed fatty acids from coconut and palm oils are more attractives than oleic. Copra in several forms has been tried and preliminary results indicate that wet mouldy copra is more attractive than well-prepared and other forms of copra.

Departmental.

FROM THE DISTRICTS.

The Weather.

In Kedah, Western Pahang and Malacca, the prolonged spell of dry weather terminated towards the end or in the middle of the month. The rain storms which followed caused somewhat severe flooding in Pahang. In Kelantan the first three weeks were cool and showery with strong winds, the last week, however, being hot and dry. Elsewhere the first half of the month was dry, but fairly heavy rain fell almost daily in the second half.

Remarks on Crops.

Rubber :—Termination of the negotiations between the Dutch and British representatives in the definite announcement that no scheme of rubber restriction would be introduced caused a further fall in the price of the commodity and put an end to speculation by local dealers. Prices of small-holders' rubber ranged in dollars per picul from 4 to 9.80 for smoked sheet, 3 to 9.60 for unsmoked sheet, 1.50—6 for scrap and 1.50—5 for lump and slab. In Selangor very little scrap rubber could be sold.

Wintering had practically finished at the end of the month and the new flush of foliage was developing well.

Owing to the decrease in yield due to wintering and the further fall in price, many owners and tappers of small rubber holdings left their holdings and took work as harvesters in the neighbouring padi fields wherever reaping was still in progress. In Penang Island and the Dindings they supported themselves by taking any work available. In practically all States only those holdings were tapped of which the owners had no other means of subsistence. During the wintering period the trees were also rested on a certain number of estates.

It appears that small-holders are now beginning to realise that no rise in the price of rubber can be expected in the near future, since they are paying more attention to their formerly neglected mixed orchards or coconut holdings and are also planting up more vegetables and food crops. As yet, however, few have the courage to cut out their rubber to make room for other crops.

The dry season combined with cessation of tapping on many holdings has checked the incidence of mouldy rot disease. With the return of wetter conditions, however, extensive outbreaks must be expected, since the poverty of many small-holders forbids the execution of adequate control measures, the purchase of even the cheapest disinfectants being now beyond their means.

Leaf mildew (*Oidium Heveae*) appeared in two localities in Province Wellesley, on seven estates in Negri Sembilan, on one estate as well as on certain small holdings in Malacca, and in the District of Muar, Batu Pahat and Segamat in Johore. The attacks were in most cases slight.

Padi:—At the end of the month the padi harvest was completed except in certain late-planted areas in parts of Kedah, the Central and Southern Districts of Province Wellesley, a few localities in Perak, parts of Kuala Selangor District and Kuala Pilah District of Negri Sembilan. Yield records available confirm the anticipation of a good crop in Kedah, Province Wellesley North and Malacca, and of satisfactory crops elsewhere. The crop in Krian is roughly estimated at about 18,000,000 gantangs, allowance being made for the fact that crops in past years have probably been under-estimated. In Kuala Pilah District yields of pure strain varieties of padi from 1/40th. acre plots have varied from 360 to 760 gantangs per acre, with an average of 480 gantangs per acre, while the corresponding figures for local mixed padi have been 200 to 400 with an average of 340 gantangs per acre. At Ulu Sat in Kelantan, Seraup Kechil No. 36 gave 688 gantangs per acre as compared with 410 gantangs from the local padi Trong. In Baroh Merangkap Nachin 27 gave 725 gantangs per acre.

In Krian prices for padi at the roadside have been between 7 and 8 cents per gantang. Prices in Kedah and Province Wellesley ranged between 7 and 10 cents and in Malacca between 6 and 9 cents; elsewhere prices were variable between 8 and 16 cents per gantang.

In the parts of Selangor where an inter-season crop is being planted, some 1,900 gantangs of seed were distributed and nurseries were sown. Nurseries were also laid down in Temerloh District wherever water was available. The repairing of dams and clearing of water-ways was commenced in parts of Negri Sembilan.

Coconuts:—The Kuala Selangor scheme for improving the quality of copra made on small holdings and encouraging the Malay owners to manufacture their own copra in making steady progress. Similar schemes have been started in Kuala Langat and in Sabak Bernam Districts, where a few cheap kilns of an improved type have been erected. The copra manufactured on these kilns is much better than the average product from small holdings and obtains a better price.

While good yields are reported from parts of Province Wellesley, yields in the coastal districts of Selangor are still much below the average. The harvesting of immature nuts for the Malay New Year in February caused a shortage of crop in March in Negri Sembilan, with a rise in the price of nuts in Port Dickson District. A scarcity of coconuts is also reported in Raub District of Pahang, where prices have risen to 6 or 7 cents each.

Tobacco:—While the area planted with tobacco is extending in most parts of the country, it is becoming considerably reduced in Province Wellesley, owing in part to low prices, adverse weather conditions and the incidence of the stem borer pest, and in part to the local transport permits required by the excise authorities to prevent smuggling under cover of local production.

Tea:—The bushes on the Chinese small holdings in Ulu Langat District showed good growth and gave a good flush of leaves after the February rains.

The price of the product, however, at 40 cents a kati for the first quality, was too low to encourage further planting.

Fruit:—In several parts of the country local fruit trees were flowering freely and giving promise of good crops later in the year. Interest in fruit cultivation is reviving and steps are being taken to enable the Agricultural Stations to meet a demand for planting material at prices within the means of small-holders.

Rat Control in Padi Fields.

In Krian District control in the proximity of houses and in breeding grounds has been continued. Specimens of rats sent to Raffles Museum were found to comprise only two varieties, the common Malayan field and house rats. In Province Wellesley and Penang, control by means of poisoned baits and traps continued. During the present breeding season, however, because rewards are no longer paid for tails in the Province, Malay padi growers and local Tamil labourers have been unwilling to undertake the work of digging nests out of the bunds of the padi fields and destroying the young, as they have done regularly in past years. In consequence, young rats were in evidence in several localities and nests full of them were found to be numerous in several bunds examined. In Malacca, where a reward of one cent for four tails is still paid, 103,814 tails were collected mainly from nests in the padi fields.

Agricultural Stations and Padi Test Plots.

KEDAH—*Telok Chengah Rice Experimental Station*:—Harvesting was completed under good weather conditions. Records of selected strains and manurial experiments were worked out and forwarded to the Department of Agriculture, S.S. & F.M.S., for statistical examination. The straw on all the plots was evenly scattered over the land to decay.

Gajah Mati Agricultural Station:—A temporary house for the officer in charge of the Station was erected and preparation was made for building nursery sheds.

PENANG AND PROVINCE WELLESLEY—*Glugor Padi Test Station*:—The harvest was completed at the end of the month. Results were disappointing, since the earlier planted varieties were so severely damaged by rats as to give no reliable yield records. The later-planted varieties did not suffer so seriously and gave average yields. Seedlings for the inter-season crop received their first transplanting and looked healthy. Plots were being prepared to receive them.

Bukit Merah Padi Test Station:—Reaping was completed early in the month. The crop was dried and weighed and a report of the yields from the different trials and experiments was submitted to Headquarters for statistical examination. Yields were good and the records are expected to give useful information.

Bukit Mertajam Agricultural Station:—Contracts were about to be let for felling and clearing and also for fencing this site.

PERAK—(a) *Agricultural Stations*—*Selama*:—An adequate rainfall during the month assisted the growth of the recently-planted crops which survived the January drought. It also provided suitable conditions for planting shade trees of *Albizzia moluccana* and a cover crop of *Indigofera endecaphylla* in the tea area, together with plots of cinnamon, brinjal, rambutan, Avocado pear, orange, groundnuts and pineapples.

Kuala Kangsar:—Further terracing work was carried out and holes were dug and prepared for planting a few budded stumps of certain selected clones of rubber. Crops planted included gingelly, cinnamon seedlings and pepper cuttings in the nursery. Harvesting the leaves from a good crop of Rangoon tobacco was commenced. Mortality has been high among young tea planted during dry weather in January, in spite of daily watering. A good crop of maize was maturing and the plot of groundnuts showed good growth. *Calapogonium mucunoides* was sown as a cover crop on plots in fallow.

(b) *Padi Stations and Test Plots, Takang*:—Harvest was completed and records of the different plots entered up for analysis. The yields obtained appeared to be good, in spite of the fact that the padi was completely submerged in the December flood.

Bruas:—Harvest was completed and yield records were being prepared.

Bukit Gantang:—Harvesting was completed on March 20th. Detailed results have not yet been calculated but yields appear to range from 161 to 590 gantangs per acre on the different plots.

Kamunting Slimed Area:—Harvesting was commenced and completed during the month. This isolated plot of padi suffered so severely from the ravages of birds, in spite of all precautions, that the yield records are of no value for comparative purposes. The yields actually ranged from 125 to 214 gantangs per acre, but it is estimated that, had damage by birds been normal, they would have been in the vicinity of 250 to 300 gantang per acre.

Selinsing Manurial Trials:—The records of results obtained have been calculated and forwarded to Headquarters for analysis.

SELANGOR—*Cheras Agricultural Station*:—Crops planted were several varieties of yams and sweet potatoes, plots of ginger and arrowroot, and cinnamon seedlings. Two varieties of tuba were transplanted into the field while the planting of certain hedges, grass borders to the paths and other improvements to the appearance of the Station received attention.

Kajang Padi Test Plot:—The work of clearing this Plot for the inter-season crop was commenced and nurseries of four additional pure strains of padi were planted.

Kuang Padi Test Plot:—The work of clearing this area for the inter-season crop was commenced and nurseries of five additional pure strains, making six in all, were established. The recently planted nurseries of Nachin 27 were found to be attacked by stem borers early in the month and were treated with tuba root solution which checked the pest.

NEGRI SEMBILAN—Seremban Fruit Nursery:—Suckers of the banana, Pisang Serendah, which had proved immune to Panama Disease at Jelebu, were planted. A root crop, known as Ubi Kling, was harvested and gave a good yield. This and other plants from the Nursery were distributed to school gardens and individual growers.

Rembau Agricultural Station:—Crops planted were cloves, varieties of yams, bananas, soya bean and tuba, with Ubi Kling and cinnamon.

Rembau Padi Test Plot:—Harvesting was continued, but birds took much of the crop.

PAHANG—Kuala Lipis Agricultural Station:—Hot weather early in the month and floods later checked the recently planted tobacco and the banana supplies. Soya bean, local maize and groundnuts were sown and cinnamon seedlings were planted in the nursery.

Temerloh Padi Test Station:—Nurseries of three more pure strains, making six including the control, were planted.

MALACCA—Pulau Gadong Padi Test Station:—The report of the season's results was completed and submitted to Headquarters for statistical examination.

Sungei Udang Agricultural Station:—Terracing in the coffee area was finished. The bund round the padi area was completed and the irrigation channel was re-graded and improved. The buildings were completed and taken over from the Public Works Department.

SINGAPORE—Pineapple Experiment Station:—Applications of manure in accordance with a revised scheme have been given to the manurial and other experimental plots. A few pulasan and rambutan marcots were planted and a small supply of seeds for raising seedlings was obtained. Eight different types of tobacco are under cultivation in small plots. The plots for manurial experiments with Hickory Prior variety of Virginian tobacco were planted up, but owing to a shortage of seedlings the scheme had to be modified to include only 41 plots.

School Gardens.

During the month, many of these gardens were re-opened after the holidays. Attention was given to improving the layout, cultivation, manuring and replanting of beds. Fences were repaired in some cases. Planting material was supplied to a number of gardens. During visits, notes were made of schools where the supply of tools was inadequate, where supplies of the seeds of common vegetables were deficient and of various matters that required attention. In Johore sites have been selected for sixteen schools gardens, to fifteen of which tools have been supplied and printed instructions on the layout and care of gardens. In these fifteen gardens the layout of beds and paths has been pegged out and their preparation is in progress; the work of felling and removing trees and stumps, where necessary, has been commenced on contract. Considerable enthusiasm is being displayed in the establishment of these new gardens.

DEPARTMENTAL NOTES.

Exhibition for Tourist Ships.

In compliance with a request from a local shipping agent, the Department of Agriculture staged an exhibit at Malacca of the products of Malayan agriculture for the benefit of the passengers of two American tourist ships which called at that port on 2nd and 3rd March, 1932.

The crops staged included rubber, coffee, tea, canned pineapples, kapok, tuba, Hydnocarpus, arecanuts, padi and rice, tapioca, coconuts, palm oil and palm kernels. The exhibits shewed the various stages—from the crop as harvested to the finished product—of each crop. Suitable photographs illustrated the field conditions under which the crops are grown and explanatory labels were intended to render the display easily intelligible to the visitors.

Most of the tourists were connected in some way with educational activities and the large majority were very much interested in this small exhibition.

Such displays as this should achieve a very useful purpose in advertising Malaya and should draw attention to the very important agricultural products of this country.

School of Agriculture, Malaya.

The Hon'ble Chief Secretary to Government and Mrs. Caldecott paid an informal visit to the School on 3rd March.

A meeting of the Advisory Committee of the School was held at the School on March 1st.

Lectures for the current school year were concluded by March 31st, in view of the approaching final and annual examinations of the students.

Vernacular Publications.

The last number of the quarterly journal of the Department (*Warta Perusaha'an Tanah*) was published on March 10th and completes the ninth annual volume of this publication. The number includes articles on rearing of carp in ponds, co-operation in native holdings, and Liberian coffee.

Volume IV, No. 1 of the Chinese Agricultural Journal was published on March 21st, and includes articles on the cultivation of cloves, fodder and grazing grasses, transport of carp fry from China and the preparation of rubber from the point of view of small-holders.

The Malayan Agricultural Journal for May 1932.

The next number of this Journal will deal with various aspects of the Malayan rubber planting industry in the year 1931. Special articles for this number have been written by the senior staff of the Rubber Research Institute of Malaya and the Department of Agriculture. These original articles will

include the following subjects—budgrafting, manuring, diseases, factory practice and preparation, a review of the industry in Malaya and the conditions obtaining in small-holdings. The close liaison with the Department of Statistics enables the inclusion of the most recent statistics concerning Malayan rubber areas and production in 1931.

Leave.

Mr. F. Birkinshaw, Senior Agricultural Officer, Perak North, has been granted 9 months and 12 days leave on full pay with effect from 6th February, 1932.

Mr. H. Ritchings, Horticultural Assistant, has been granted 9 months and 18 days leave on full pay with effect from 3rd March, 1932.

Dr. T. A. Buckley, Assistant Chemist, has been granted 8 months and 6 days leave on full pay with effect from 11th March, 1932.

Statistical. MARKET PRICES

March, 1932.

The better values ruling for sterling have, generally speaking, resulted in lower commodity prices. Markets have shown a declining tendency, demand from America and the Continent being particularly weak. The Easter holidays also was a contributory cause of the easy markets.

Rubber.—The official pronouncement against the introduction of a scheme of compulsory restriction has reacted unfavourably on the rubber market, the price having touched a new low record price of $5\frac{1}{4}$ cents per lb. Singapore, 1 15/16d London and 3 1/16 cents gold New York. Average prices per lb. for the month were as follows:—Singapore, 6.39 cents, London, 2.16d, New York 3.3 cents gold, as compared with 8.18 cents, 2.71d, and 3.95 cents gold respectively for February.

Palm Oil.—The following cabled quotations are c.i.f. Liverpool, f.f.a. basis of 18 per cent. March 2nd £21; 9th £20.15; 18th £19.10; 23rd and 31st £19. The market opened the month steady and ended idle.

The average price for the year 1931 quoted locally for palm oil c.i.f. Liverpool, basis 18 per cent. f.f.a. was £18.8.3, while the average quotations for palm kernels (basis 49 per cent. oil) was £9.19.2.

Copra.—The Singapore market shewed a steady decline throughout the month for both sundried and mixed. The highest price of sundried was \$6.50 and the lowest \$5.75 per picul, the average price for the month of this grade being \$6.17 as compared with \$5.67 in February. Mixed averaged \$5.67 in March as compared with \$5.33 in the previous month.

Copra cake was quoted at \$2.20 throughout the month.

Gambier.—The average price of Block gambier was \$11.80 per picul and of Cube No. 1 \$18.90 as compared with \$13.12 and \$20 respectively in February.

Rice.—The following are the average wholesale prices of rice per picul in Singapore during February. Siam No. 1 Ordinary \$4.62; Rangoon No. 1 \$4.17; Saigon No. 1 \$4.37 as compared with \$4.46, \$3.92 and \$4.26 respectively in January.

The average retail market prices in cents per gantang of No. 2 Siam rice were as follows:—Singapore 32, Penang 38, Malacca 26.

Arecanuts.—During March, Palambangs averaged \$3.49 per picul as compared with \$3.62 per picul in the previous month, and Bila Whole \$3.59 as compared with \$3.76 per picul in February. For other grades the average prices per picul in March were:—Split, \$4.58 to \$5.83; Red Whole \$6.50 to \$6.90; Sliced \$9.15 to \$12.50; Kelantan \$5.53, the prices within each range depending upon quality.

Coffee.—Prices have declined somewhat from those ruling at the end of January. Java Robusta dropped from \$22 per picul to \$20.25, the average price for March being \$20.95—\$22.50 per picul, the price within this range depending

upon quality. Palambang declined from \$18 to \$15.75, the average price being \$16.83 as compared with \$15.69 per picul in February.

Pineapples.—Harvesting of the "big crop" has now begun, but the Home buyers are indifferent and on a stagnant market the prospects of a prosperous season for canners are not at the moment bright. Prices shewed a declining tendency throughout the month. Average Singapore prices per case in March were :—1½ lb. cubes, \$3.63; 1½ lb. sliced flat, \$3.41; 1½ lb. sliced tall \$3.73 as compared with \$3.89, \$3.57 and \$3.80 respectively in February.

Tapioca.—Singapore average prices per picul for March were as follows :—Flake fair, \$3.12; Pearl, seed, \$4.48; Pearl medium, \$4.70. Corresponding prices in February were—\$3.14, \$4.44, \$4.46.

Sago.—Demand has been steady from Eastern buyers, but Home consumers shew no anxiety to fill forward requirements. Pearl small fair averaged \$4.45 per picul as compared with \$4.37½ in February. Flour, Sarawak fair, averaged \$2.38 as compared with \$2.70 in February.

Nutmegs and Mace.—Little enquiry, prices shewing a downward tendency. Singapore average prices for nutmegs in March were 110 per lb., \$26.90; 80 per lb., \$30.70 as compared with \$28.80 and \$31.75 respectively in February Siouw mace averaged \$59.40 per picul and Amboina \$44 per picul as compared with \$59.75 and \$46.75 respectively in February.

Pepper.—The market steadily declined, buyers in Europe adopting a hand-to-mouth policy and demand from Eastern consumers being small. London stocks showed a further increase. Average Singapore prices per picul in March were :—Singapore black, \$22.30; Singapore white, \$27.90; Muntok white, \$28.35. Corresponding prices in February were \$23.87½, \$30.87½, \$31.50.

Cloves.—Nominal prices have been quoted throughout the month in Singapore at \$45 per picul for Zanzibar and \$50 for Amboina.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore and a report on the Coconut Oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133½ lbs.

The Dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.

February, 1932.

Malaya.—Gross foreign imports of rice during February amounted to 62,573 tons as compared with 56,782 tons for the same month of 1931, of which 61.7 per cent. were consigned to Singapore, 20.4 per cent. to Penang, 3.4 per cent. to Malacca, 13.4 per cent. to the Federated Malay States and 1.1 per cent. to the Unfederated Malay States.

Of these imports, 52.1 per cent. were from Siam, 45.5 per cent. from Burma, 1.4 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice in February 1932 were 16,346 tons as compared with 13,700 tons in February 1931. Of these exports 80 per cent. went to the Netherlands Indies.

Local padi reports indicate that work for the season 1931—32 is in hand in all areas. Harvesting was completed or finished in Perlis and Kedah, where crops are generally reported as being better than for the previous season.

India.—The total area under rice (season 1931—32) is reported at 84,034,000 acres as compared with 82,706,000 acres in 1930—1931, an increase of 1.6 per cent. and the total yield is estimated at 32,770,000 tons of clean rice as against 32,198,000 tons the previous season, or an increase of 1.8 per cent. A record area has been brought under cultivation and a good crop is expected this year except in Burma.

Total foreign export of milled rice (*Indian Trade Journal* 3.3.1932) during December 1931 were 151,000 tons as compared with 102,000 tons in December 1930, an increase of 49,000 tons or 48 per cent.

Total foreign exports of milled rice during the year 1931 were 2,092,000 tons, a decrease of 487,000 tons or 19 per cent. as compared with 1930, and a decrease of 123,000 tons or 5.6 per cent. as compared with the average of the past six years

The Final Forecast of the Rice Crop in Burma for the season 1931-32 issued on February 13, 1932, gives the area likely to mature as 11,972,000 acres, being 626,000 acres or 5 per cent. less than the final figures of last year. The exportable surplus is still estimated at 3,649,000 tons of padi equivalent to 2,700,000 tons of rice and rice products.

Total exports of rice and rice products from Burma for January 1932, amounted to 291,541 tons as compared with 257,880 tons for the corresponding period of 1931 or an increase of 13.1 per cent.

According to the *Bangkok Times* of February 26, 1932, the heavy orders for rice for Shanghai and the shortage of the crops in Japan, Korea, Siam and Saigon have created a demand for Burma rice and upwards of 700,000 tons had been sold forward for May delivery at Shanghai at prices ranging from Rs. 275 to Rs. 285. Padi has been held up in the districts where the price of Rs. 150 is being demanded against Rs. 110, Rs. 115 offered with only limited quantities

available, and rice is quoted at Rs. 255 to Rs. 260 for February with business being done at Rs. 275 to Rs. 280 for March and April, with higher prices for May. These prices are the highest reached since the last quarter of 1930.

Siam.—Exports of rice from Bangkok during January, 1932, were 108,883 tons as compared with 128,371 tons in January 1931, a decrease of 15 per cent.

Netherlands Indies.—Java and Madura. The *Korte Berichten* states that at the end of January 1932, the area harvested amounted to 208,250 acres, an increase of 38,500 acres or 23 per cent. as compared with January 1931, the area damaged to 3,563 acres an increase of 984 acres or 38 per cent. as compared with January 1931, and additional plantings awaiting harvest to 5,264,000 acres an increase of 50,750 acres or 1 per cent. as compared with January 1931, a total of 5,475,813 acres as compared with 5,385,579 acres in January 1931, an increase of 1.7 per cent.

The area of wet and dry padi harvested in Java and Madura in 1931 amounted to 8,555,000 acres, while the production of this area totalled 5,004,000 tons of rough rice. The imports of rice in 1931 amounted to 282,000 tons and exports to 10,000 tons.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 29.2.32 amounted to 189,789 (metric) tons, an increase of 43,329 tons or 30 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 29.2.32 amounted to 188,335 (metric) tons, an increase of 74,893 tons or 66 per cent. as compared with the same period of 1931.

The following is an extract from the *International Crop Report, Rome*, for January 1932:—"Indo-China: Drought has generally hindered transplanting of the second crop but the duration of its effects has varied according to region. In Tonkin, despite the delay in transplantings, the very early rains allowed operations to be completed under good conditions and transplantings of late varieties to be prolonged. The area planted is also greater than normal and a crop at least equal to the average was expected. In Annam conditions have varied greatly; save in the south, the drought has reduced the area transplanted and has been very prejudicial in a number of sectors so that, on the whole, the crop of the second semester appears to be mediocre.

In Cochinchina the rainfall regime has been very variable, deficient in the majority of provinces and excessive in others. Consequently the condition of transplantings and standing crops varied greatly. In Cambodia the rains, more or less abundant according to region, permitted all the fields to be brought under cultivation. The situation was satisfactory. In Laos the drought hindered the transplanting of an important part of the lowland fields in some provinces; other provinces suffered from lack of water. Condition of upland rice was satisfactory."

The padi market (official report) in January 1932 was fairly active. Arrivals of new crop padi were becoming more frequent. Rates remain fairly steady. The considerable quantities bought and sold during the second half of the month

made very little difference to the price. Large quantities of all kinds are now stocked in Cholon.

In the rice market, a certain amount of business was transacted. There were enquiries from aboard for immediate shipment and France continued to buy steadily. Some attempts to do business with Shanghai and Java were reported, and shipments on the former port slowed down considerably owing to the political and financial situation. The Hong Kong market was calm. The market closed on a calm note with a tendency to weaken.

The Brokens market was steady, enquiries being numerous. Certain sellers, considering the prices offered by the exporters as excellent, sold large consignments in advance without any stocks to back them. Stocks are low and the market closed very firm.

Japan.—The area under rice for the 1931 rice crop amounted to 7,959,406 acres, an increase of 23,070 acres or 0.3 per cent. compared with 1930. The production amounted to 7,744,076 tons, a decrease of 1,635,356 tons or 17.4 per cent. as compared with 1930, due to bad weather conditions.

According to the Japanese Government, supply and demand for the year ending 1932, are estimated as follows:—

<i>Supply Tons.</i>			
Stocks on November 1, 1931	...	1,282,000	
Actual Rice Crop	...	7,744,000	
Korean Imports	...	912,000	
Formosan Imports	...	351,000	10,289,000
<i>Demand Tons.</i>			
Exports	...	108,000	
Consumption	...	10,184,000	
Retention as Government Stocks	...	701,000	10,993,000
Deficit	...		704,000

According to the *Bangkok Times* of February 26, 1932, Japan had dropped her embargo against the purchase of foreign rice owing to the shortage of her own crop, as well as that of Korea, Siam and Saigon, was buying where she could, and had placed orders in Burma for the bulk of the shipments to Shanghai.

Korea.—According to the Ministry of Overseas Affairs the production of rice for the year 1931 amounted to 2,226,227 tons, a decrease of 463,910 tons or 17 per cent. as compared with 1930.

Formosa.—The area under rice for the second crop of 1931 was 887,760 acres, an increase of 30,535 acres or 4 per cent. as compared with the corresponding crop of 1930, and production amounted to 540,145 tons a decrease of 5,116 tons or 1 per cent. as compared with the second crop of 1930.

Italy.—In Italy the area and production of rice (1931—32) are estimated at 346,000 acres and 621,340 tons as compared with 361,000 acres and 639,870 tons

in 1930—31, being decreases of 4 per cent. in area and 3 per cent. in production.

America.—In America the area and production of rice (1931—32) is estimated at 970,000 acres and 904,286 tons as compared with 959,000 acres and 889,955 tons (1930—31), increases of 1 per cent. in area and 1.6 per cent. in production.

For the period January 1 to December 18, 1931, a total of 159,223 tons of rice were shipped from the East to the West Indies and America, as compared with 200,644 tons in 1930.

Quantities of rice shipped from the East were :—

- (a) To Europe, period January 1 to February 11, 1932, 52,000 tons as compared with 35,333 tons for the same period of 1931, or an increase of 47.2 per cent.

Of this 62.5 per cent. was from Burma, nil from Japan, 33.4 per cent. from Saigon, 2.2 per cent. from Siam, and 1.9 per cent. from Bengal as compared with 16.1 per cent. from Burma, 23 per cent. from Japan, 39.8 per cent. from Saigon, 20.6 per cent. from Siam, and .5 per cent. from Bengal in 1931.

- (b) To the Levant, period January 1 to December 30, 1931, 71,305 tons, an increase of 49,810 tons or 231.7 per cent. as compared with 1930.

According to the *International Institute of Agriculture monthly Crop report* for January 1932, information concerning the probable production of 1931—1932 in the major exporting countries shows the following :—

- (a). *Burma* : A decrease of 12.8 per cent. in production,
- (b). *Indo-China* : A decrease in the total production,
- (c). *Siam* : A decrease of 17 per cent. in production (Seven exporting circles).

The report also states the following : “ Now that it is definitely known that there has been a marked decline in the production of Siam, much more pronounced than in that of Burma, while unfavourable weather has further reduced the crop in the latter country and seems likely to have a similar effect in much of the Indo-Chinese area, the situation on the supply side may be said to be somewhat more favourable than it could be said to be last month. On the demand side, however, prospects still remain very doubtful.”

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN MALAYA, JANUARY, 1932.

(Estates of 100 acres and over.)

AREA (1)	Acreage of Tappable Rubber (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
Federated Malay States	...	789,444					
Johore	...	298,778	4.5	90,703	11.5	126,247	16.0
Kedah (a)	...	11,175	6.6	42,667	14.3	62,298	20.9
Kelantan	...	16,785	9.4	15,706	13.3	26,881	22.7
Trengganu (c)	...	4,300	40.2	796	4.7	7,538	44.9
Perlis	...	624	nil	nil	nil	nil	nil
Straits Settlements	...	210,642	49.4	156	25.0	464	74.4
			8.7	32,287	15.3	50,519	24.0
MALAYA	...	1,438,809	6.4	184,315	12.6	273,947	19.0

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with end June 1931, inclusive.

(b) Estimated in the ratio of acreage of tappable rubber to acreage planted end 1930.

(c) Registered companies only.

2. Areas rested due to rotational tapping system end January : acres F.M.S. 44,097, Johore 31,679, Kedah 34,713, Kelantan 1,005, Trengganu 1,394, S.S. 15,171, total 128,059 acres or 8.9 per cent. of tappable area (Col. 2).

SINGAPORE, March 29, 1932.

J. I. MILLER, M.C.S.
Ag. Registrar-General of Statistics,
S.S. and F.M.S.

THE OIL PALM INDUSTRY IN MALAYA, 1931

Area.—A total of 4,193 acres were planted with oil palms during the year, of which all but 877 acres were planted in Johore. The total area under this crop at the end of 1931 was:—Perak 17,165 acres, Selangor 13,092 acres, Negri Sembilan 920 acres, Pahang 788 acres. Total F.M.S. 31,965 acres. In addition there are 24,395 acres in Johore and 600 acres in Kelantan, giving a total area in Malaya of 56,960 acres.

Production.—There are 16 oil palm factories some of which, being newly erected, were in operation for only part of the year.

Actual production, as declared by estates, amounted to 5,135.6 tons of palm oil and 772.9 tons of palm kernels.

Exports.—The exports of palm oil and kernel from Malaya amounted to 4,574 tons palm oil valued at \$1,009,610 and 726 tons of kernels valued at \$112,093. The figures of exports for 1930 were:—palm oil 3,211 tons valued at \$892,995 and kernels 485 tons, valued at \$80,792.

Prices.—The average price of palm oil in 1931, quoted locally c.i.f. Liverpool, basis 18 per cent. f.f.a. was £18. 8s. 3d. per ton, while the average of prices received locally for kernels, c.i.f. Liverpool, basis 49 per cent. oil was £9 19s. 2d per ton.

MALAYAN AGRICULTURAL EXPORTS, JANUARY 1932.

PRODUCT	NET EXPORTS IN TONS		
	Year 1931	January 1931	January 1932
Coconuts, fresh ...	10,468	540	6,559 *
Copra ...	100,809	7,579	5,494
Coconut Oil ...	9,909	814	959
Palm Oil ...	4,574	295	392
Palm kernels ...	726	14	45
Pineapples, canned	59,457	5,481	5,623
Tapioca ...	28,257	2,347	1,881
Arecanuts ...	19,266	1,854	3,073
Gambier, all kinds	2,563	185	246
Tuba root ...	74	5	5†

* '000 in number.

† Excess of imports over exports.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT						EARTH TEMPERATURE		RAINFALL						MONTH SUMMARY				
	Means of		Absolute Extremes				At 1 foot	At 4 feet	Total		Moist in a day	Number of days				Total	Daily Mean	Per cent	
	A.	B.	Max.	Min.	Mean of A and B	High.			Low.	High.		Low.	Precipitation .01 in or more	Precipitation .05 in or more	Thunder storm				Fog morning or afternoon	Gale force 8 or more
	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor	91.8	70.9	81.3	68	80	74	83.3	83.8	7.34	186.5	1.30	16	13	9	2		192.85	6.65	
Bukit Jeram, Selangor	88.6	71.8	80.2	69	82	74	85.0	85.6	3.60	91.5	0.92	9	7				233.80	8.06	
Sitiawan, Perak	89.5	71.9	80.7	68	85	75	83.5	83.7	5.04	128.0	1.33	16	13	6	1		227.20	7.83	
Kroh, Perak	88.6	68.0	78.3	62	61	79	71	80.5	5.83	148.1	1.46	12	10	1	1		222.95	7.69	
Tenerloh, Pahang	87.3	71.3	79.3	69	78	75	82.9	83.2	2.88	73.2	0.77	11	9	3	9		196.65	6.78	
Kuala Lipis, Pahang	87.8	71.0	79.4	67	80	74	82.7	82.5	3.78	96.0	1.06	14	9	2	15		197.40	6.81	
Kuala Pahang, Pahang	84.3	75.2	79.7	66	71	79	82.5	82.7	9.19	233.4	5.60	12	8	1			248.85	8.58	
Mount Faber, Singapore	88.1	72.3	80.2	70	80	74	80.5	81.3	5.12	130.1	2.72	11	8	4	2		219.75	7.58	
Butterworth, Province Wellesley	88.7	72.9	80.8	72	83	75	83.8	84.2	12.14	308.4	4.91	10	8			1	251.00	8.66	
Bukit China, Malacca	87.6	73.0	80.3	70	75	75	81.9	82.3	3.55	90.2	1.47	7	7	1			236.10	8.14	
Kluang, Johore	87.9	71.1	79.5	67	75	73	80.8	81.3	2.93	74.4	1.52	8	7	1	1		219.50	7.57	
Bukit Lalang, Mersing, Johore	82.9	72.0	77.5	65	68	77	79.3	79.2	11.19	284.2	6.08	7	5	1	1		227.95	7.86	
Alor Star, Kedah	92.6	70.2	81.4	65	68	74	83.8	84.1	1.92	48.8	1.61	4	4		2		251.40	8.67	
Kota Bharu, Kelantan	85.6	70.5	78.1	68	67	83	80.9	81.3	1.98	50.3	0.86	7	3				243.70	8.40	
Kuala Trengganu, Trengganu	84.4	71.0	77.7	67	69	79	76	81.4	1.78	45.2	0.89	8	6		2		243.45	8.39	
HILL STATIONS.																			
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	73.3	57.8	65.1	75	55	67	60		9.09	230.9	1.98	19	4		2		161.35	5.56	
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	72.2	54.7	63.5	75	47	68	61	68.4	9.35	237.5	1.74	19	15		4		160.75	5.54	
Fraser's Hill, Pahang 4208 ft.	71.6	61.0	66.3	77	59	65	63	70.0	69.8	12.00	304.8	2.51	18	14	21		159.25	5.49	

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

MAY, 1932.

EDITORIAL.

Rubber.

The recent decision against compulsory rubber restriction has at least the advantage of having swept away some of the uncertainty which encompassed the industry. Estate financial policy, in most cases, depended upon the settlement, one way or the other, of the discussions of 1931 on the subject of restriction. Although the decision may have come as a disappointment to many, yet it is welcome by reason of the fact that estates can now frame their policy with a clearer perception of the serious problems that have to be faced.

To assist the industry as far as possible in these considerations we have attempted in this number to review Malayan rubber production, both statistically and from the point of view of estate management, in respect of the year 1931.

The subject matter emanates from the Rubber Research Institute of Malaya, the Department of Agriculture, S.S. and F.M.S., and the Department of Statistics, S.S. and F.M.S. The close liaison maintained between these three organisations has enabled this information for 1931 to be issued at this early date.

It is a truism that the present crisis of the rubber planting industry is the result of under-consumption rather than over-production.

Less than a decade ago a very able journalist, who resided in Malaya for many years and had made a study of the economics of the rubber position, publicly stated that by 1932 the demand for rubber would by far exceed the supply.

The author of this forecast did not visualise the present disorganisation of world trade, and it is possible that, but for the state of world finance, the normal expansion of rubber consumption would have kept pace with the increasing supplies.

However, the industry to-day finds itself in a position to produce ever-increasing quantities of rubber on a market glutted with stocks and in the face of a consumption that evinces little signs of recovery.

The fall in the price of rubber has necessitated the reduction of cost of production on estates. This has been achieved generally by drastic economies in labour and management expenses, the postponement of all but urgently necessary agricultural improvements, and the tapping of the highest yielding areas only. In addition, the industry has been maintained in no small measure

by relying on reserve funds and the investment of more capital in the hope of tiding over the present difficult period.

The trend of present policy in the endeavour to maintain the industry is to increase the productive capacity. This is seen in the curtailment of tapping of the less productive areas, and the increase of budgrafted rubber. Concurrently, efforts are being made, and have already produced significant results, in lowering factory costs by dealing more efficiently with crops harvested.

While wages are at an unduly low level, and field improvements reduced to a level which should not be considered as permanent, there is little doubt that the cost of production of rubber will in the future be on a lower level than hitherto.

The present policy appears to aim at meeting over-production and under-consumption by more intensive production on areas actually in tapping and in the attainment of this object scientific research is closely allied with producers.

Critics of the present policy deplore the efforts of the scientist to increase production in the face of steadily accumulating stocks. We cannot concur in the contention that scientists are thus aggravating a serious position and that they are therefore not serving the best interests of the industry that supports them.

The aim of science in all commercial fields has undoubtedly been to contribute to the cheapening of the means of production by increased output, but this object is an aid to industry and of benefit to the community at large, and is not the cause of our present troubles.

The justification of the aims of science has been ably defended by Dr. Seligman in a recent speech at Newcastle. He pointed out that the fault lies not with the results of scientific production but with our legislators, our manufacturers, our economists and our workers who are not accustomed to the exercise of the powers thus placed in their hands. Modification of old ideas are necessary to meet the new standards which will result in better conditions for the individual.

The policy should not be to deny the use of science, but to encourage science to further achievement and for the world to harness the results with common sense, caution and responsibility.

To return to our present difficulties in the rubber industry, the need is not for fewer scientists, but for their encouragement, in showing the way to more efficient production and in devising new applications which will not only result in the consumption of excess stocks and future deliveries, but be of ultimate benefit to mankind.

The rôle of science in the rubber industry has been a most creditable one. In a comparatively restricted area there now exists about ten-thousand million rubber trees. With the aid of science, this population has been made to improve in yield and in quality.

The signal services of science to the industry in the past does not indicate that nothing more may be expected from research, but rather that science may

still prove a source of inspiration to further improvements in production and to a wider application of the use of perhaps the cheapest product with the widest range of possible applications that there is in the world to-day.

Finally, we would draw attention to the improvements in production which have been made during the past year, a brief account of which is given in the following pages. These improvements touch on the subject of production from almost every angle.

Not least of the services to the industry is that of the statistical information which of recent years has been vastly improved and more systematically presented. In this service, as indeed for all work connected with the industry, the close contact of the various branches of science is essential, but equally important is the close contact of scientists with both producers and consumers. Research must understand the needs and difficulties encountered by all branches of the industry. We are fortunate that in this country investigators and producers give mutual support, while a similar liaison is daily becoming stronger between scientific workers and consumers.

THE PREPARATION OF RAW RUBBER.

Recent Advances in Estate Factory Methods.

BY

B. J. EATON, O.B.E., F.I.C., F.I.R.I., F.C.S.

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For many years there has been little revolutionary change in rubber estate factory methods for the preparation of raw rubber.

The phenomenally high market prices of raw rubber have militated against such changes since there has, until recently, been no great incentive for improvement of machinery and equipment for the preparation of the two principal grades of "first latex" rubber—smoked sheet and thin pale crepe.

The principal improvements have been the general installation of large coagulating tanks and the increased application of aluminium for such tanks and other equipment in place of the old cement tanks lined with glazed tiles or wooden tanks with wood partitions. On large estates the use of coagulating pans is practically obsolete.

These innovations have resulted in the bulking of larger quantities of latex, thus improving the uniformity of the raw product.

In view, however, of manufacturers' complaints of lack of uniformity not only in rubber from different estates, but also in rubber prepared at different times on the same estate, which is confirmed by our own investigations, it is obvious that there is still room for further improvement in this direction, which can only be effected by further bulking of large quantities of latex and greater attention to uniformity of preparation starting with the dilution of the latex and the subsequent machining, drying and smoking under more standard conditions.

Smoked Sheet *versus* Thin Pale Crepe.

Owing to the fact that the premium on thin pale crepe has until recently been insufficient to render the preparation of this grade economical in relation to smoked sheet, several estates have abandoned its manufacture.

At the present time, owing to this fact that a number of estates have ceased to prepare thin pale crepe, the tendency is to create a much larger margin in the market price in favour of such crepe. Its preparation may therefore again increase on estates equipped with heavy crepeing machinery.

In view of the present and prospective future prices, it is extremely doubtful, however, whether any new estates will adopt the preparation of this grade especially since investigations at the Rubber Research Institute indicate the probability of the substitution of a thin pale sheet which can be used in its place.

This will be discussed later under the section dealing with air-dried sheet.

Factory Machinery for Sheet Manufacture

The greatest and most revolutionary advance which has taken place recently,

as a result of investigations carried out at the Rubber Research Institute, has been the construction and installation of batteries of light sheeting machines in cascade or file formation instead of in line, in order to facilitate and accelerate the handling and machining of the coagulum.

As a result of investigations on a large number of estates, it was ascertained that the best outputs on the average estate light sheeting batteries in operation were about 500 lbs. of dry rubber per hour on a battery of three smooth and one marking machine.

By increasing the depth of coagulating tanks, and installing 24 inch roll machines in file formation, outputs of 2,500—3,000 lbs. of dry sheet per hour are now attained. Careful attention, however, has to be paid to the correct synchronisation of the machines, so that there is no accumulation of coagulum between each machine and that no machine is running "idle".

Sheets of 18 inch width when dry can be prepared, which fit the normal wooden packing cases.

By nipping together the ends of each strip of coagulum from the coagulating tanks or by cutting the alternate ends of each aluminium partition in the coagulating tanks, a continuous coagulum can be machined.

This necessitates a plentiful supply of water to maintain the coagulating tanks full, during machining, so that the coagulum floats and can be easily handled. Aluminium chutes to convey the coagulum to the first machine and between the successive machines are also essential to reduce handling and to accelerate the operations.

Such a battery can be operated by three labourers. A battery consisting of at least five and preferably six machines is recommended, in order to prepare a satisfactory and uniform product.

A more recent battery constructed by a local engineering firm consists of one three-roll machine, two two-roll machines and a two-roll marking machine driven by a 5 H.P. prime mover. Although this battery has not yet been tested under the most efficient conditions, it appears capable of an output of 2,500—3,000 lbs. of dry sheet rubber per hour. Such batteries are sufficient to treat the crop from an area of 6,000 acres.

It is realized that many estates are unable for financial reasons to re-organise their present factories by scrapping their present machinery and installing these new batteries, and also that smaller areas may not gain much advantage by so doing. It has, however, been demonstrated on a number of smaller estates that considerable increase of output and saving of factory labour can be effected by minor alterations at a small cost. On a number of estates, savings considerably in excess of the cess paid to the Institute have been effected as a result of recommendations made and adopted.

Drying and Smoking of Sheet Rubber.

Considerable attention has also been devoted to improvements in the drying and smoking of sheet rubber,

It has been shown that a large portion of the moisture in sheet rubber can be removed by air-drying for 5 to 6 hours at normal temperature in a shaded but well ventilated site, before the sheets are placed in the smoke house. This enables the sheet to be smoked in 4 to 5 days, or less than half of the normal period previously practised and results in considerable economy of wood fuel.

The necessity for better ventilation of both smoke houses and fire boxes and the better distribution of heat has also been demonstrated.

It has also been shown that most outbreaks of fire in smoke houses are due to the accumulation of inflammable gases due to insufficient ventilation of the fire boxes resulting in the dry distillation of the wood fuel which produces such gases. The lack of ventilation in the smoke house itself causes these gases to accumulate and a spark may ignite them causing an explosion and subsequent fire.

Air-dried Sheet.

Investigations have indicated that air-dried sheet, provided it is dried at not too high a temperature, is a satisfactory substitute for smoked sheet and enables the raw product to be dried under more controlled conditions by the use of hot water or steam pipes.

One large company is already preparing its rubber in this manner and several consignments of such sheet have been shipped by other estates.

Another aspect of this problem is the substitution of a pale air-dried sheet for thin pale crepe.

In order to obtain the pale colour it will be necessary to add sodium bisulphite to the latex, since such pale rubber is used in the manufacture of pale transparent dipped goods.

In view of the fact that thin pale crepe contains a minimum amount of non-caoutchouc serum products, due to its washing and machining, it will be essential to remove such products from sheet by prolonged soaking in running water. Such products when left in the raw rubber produce a cloudy appearance which is not desirable in the finished dipped goods. They also render the rubber less uniform in vulcanisation and tend to increase mould development ("Spot" disease). The preparation of a thin pale sheet even at the rate of 1,000—1,500 lbs. per hour on light sheeting machinery will be a great advance on the output of the present heavy crepeing machines and will eliminate all heavy machinery except for central factories in districts for the treatment of the 10—15 per cent. of lower grades (tree scrap, lump, etc.).

Any estate, with a suitable drying room, as well as a smoke house, could prepare either smoked or ordinary air-dried sheet or the thin pale air-dried sheet according to market requirements and price.

Sole Crepe.

The demand for sole crepe appears to have become more than stabilised resulting in low prices for this product, which are scarcely economic. This is due partly to an increase in the number of estates now preparing this product

and the fact that manufacturers of vulcanised rubber soles have improved and cheapened their products to compete with sole crepe prepared on estates.

New Types of Raw Rubber.

Investigations on types of raw rubber more suited to manufacturers' requirements are being initiated and also special types of raw rubber which are required for specific purposes. These embrace particularly rubber used for the manufacture of ebonite (vulcanite) for insulation purposes, which probably requires a minimum of hygroscopic serum products in the finished product and also more plastic raw rubber which may replace reclaim or may be more economical to mill.

At present the situation appears to be somewhat chaotic judging from opinions expressed by various manufacturers or their technical advisers.

It is hoped to clarify these views, which may be due to different methods of manufacture and articles manufactured, by more detailed and personal enquiries with the leading manufacturers.

The manufacture of different types of raw rubber on estates will also almost certainly require alterations in present methods of marketing, since the buyer is not in a position to determine the intrinsic properties of raw rubber which are of importance to the manufacturer.

In this connection a few remarks *apropos* recent statements in the technical literature on the subject of the futility of the preparation of "pretty" rubber are desirable.

While the chemist working on behalf of the producer is compelled to devote his attention to defects in raw rubber which affect its selling price when purchased by the usual buyer who is not a manufacturer, it is realised that many of these so-called defects are of no importance to the manufacturer. The importance of cleanliness and freedom from fine sand or other debris is, however, of great importance, and satisfactory methods have been recommended for eliminating foreign matter of this kind.

At the same time, it may be emphasized that sheet rubber of uniform appearance and regular thickness does not necessarily cost more to prepare than sheet of irregular appearance with thick corners and edges. In fact, the latter may cost more, by requiring a longer period of drying resulting in extra cost of fuel, while it may result also in considerable cutting out of the undried portions resulting in a loss of price.

In the case of thin pale crepe required especially for the manufacture of thin pale dipped goods, colour and evenness of appearance are essential.

Finally, it may be stated that a raw rubber of good appearance and even thickness indicates care in preparation and uniform methods of preparation which are more likely to result in uniform properties.

Packing of Rubber.

It has been shown that considerable economies in packing can be effected by the use of treated hessian in place of the usual wooden chests. Enquiries have been addressed to the Rubber Growers' Association in relation to this problem. Such packing is already adopted by several large buyers.

Latex and Concentrated Latex.

Considerable increase in the export of latex is taking place which indicates increasing application of latex for present or new uses.

Difficulties in connection with the sampling and determination of dry rubber content of such latex have occurred and are being investigated. The ammonia solution used as a preservative also appears to be irregular in strength and results in bad consignments being prepared. Several estates have adopted with satisfactory results, our recommendations to use the compressed anhydrous ammonia gas imported in steel cylinders, especially owing to the danger in opening and handling the strong ammonia solution (Liquor Ammon Fortis) which at tropical temperatures is under considerable pressure in the drums in which it is contained.

There also appears to be a considerable demand for latex containing 4 lbs. of dry rubber per gallon, a concentration which is not easy to obtain on all estates. Revertex (latex concentrated by evaporation in the presence of a protective colloid) is still manufactured on one estate, but its production has ceased on the estate on which its preparation was originated. Considerable quantities of latex concentrated by the Utermark process in centrifuges are exported by the Dunlop Rubber Plantations Ltd.

Investigations on creaming process for concentration and also on alternative methods of preservation are in progress at the Institute. The Rubber Growers' Association and manufacturers are interested in this problem and have invoked the collaboration of the Institute.

Non-caoutchouc Constituents of Latex.

Progress has been made in the investigation of the non-caoutchouc constituents of latex which, although present in small quantities, have a profound influence on the properties of the prepared rubber.

Considerable quantities of quebrachitol (1—methyl inosite) have been prepared in a pure state from the serum of latex and distributed among various chemical manufacturers with a view to its possible utilisation. An interesting substance, Lipin, has also been isolated and found to confer peculiar properties on the raw rubber. Its similarity to lecithin derived from eggs and soya bean has been indicated. While the amount present may be too small for extraction for commercial application, the investigation of this and related products may prove to be of value in relation to rubber and other industries.

Rubber Roadways and New Uses

The utilisation of latex in conjunction with road-making products, such as asphalt or bitumen and their emulsions and other cheap fillers, is under investigation at the Institute with a view to the possibility of preparation of suitable products in a paste form which can be spread as a road-surfacing material.

The difficulties of converting laboratory results into large scale practical operations have been demonstrated and have still to be overcome. It is too early to make any statement as to the probable success of such investigations.

Investigations into the application of latex as a paint vehicle also show promising results, but the practical application of such products will depend on their utility compared with products already in use.

It may be emphasized that considerable progress is being made by rubber and other manufacturers in the direct use of latex for new uses, particularly for the manufacture of sponge rubber for upholstery, cushions, etc. and in other directions.

These investigations, and more especially the adoption of the products, must necessarily be slow.

BUDDING OF RUBBER TREES.

The Position in 1931

BY

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Plant Breeder, Rubber Research Institute of Malaya.

During 1931 although relatively small areas were newly planted with rubber, the enquiries dealt with by the Botanical Division of the Rubber Research Institute indicate that the interest in budding problems was fully maintained.

Apart from numerous enquiries covering varied details of the general technique of budding and the after-care of budded plants the subject most frequent dealt with was the choice of clones for immediate planting or multiplication for the future. There was also an increased interest in the budding of stocks older than the usually recommended year or eighteen months.

The clones recommended for planting included the oldest clones in Malaya, Java and Sumatra, of which the published yields are shown in the table.

Yields of Various Clones.

The yield of clone Bodjong Datar 5 increased from the 12th to 13th year after establishment, and this clone can be regarded as very satisfactory. Growth in the first year after budding may be rather slow, but the plants look very vigorous and grow more rapidly in the second year.

The yield of clone Bodjong Datar 10 has remained almost constant. This clone has received some criticism because the trunk is rather flattened and not circular in section, but it is considered that this character is not sufficiently pronounced to interfere with tapping.

Clone Tjirandji 1 has been the subject of many adverse rumours. In the beginning of 1929 a windstorm destroyed three out of five trees. The mean yield of the two trees left was about the same as the mean of all. In 1930 these two trees gave 31.6 pounds per tree per 160 tappings. This yield is so high that (assuming an average variation) there is a very big chance that it is really a good clone and worthy of inclusion in planting programmes. It has been used extensively by Tjirandji and sister estates and young trees were brought into tapping during the year. The yields of clone Tjirandji 16 dropped slightly.

Unfortunately, owing to shortage of staff and so on, the AVROS Proefstation did not publish the 1930 yields of their clones, and recommendations had to be based on previous records. For 1931 planting, however, the Proefstation recommended the same clones as before,—49, 50, 152, 256 with the younger clones 185 and 214.

Monthly records of the prominent Malayan clones were received and a number of visits of inspection were paid by the Botanical Division of the Institute. Several clones reached the age of ten years and completed four years' records of tapping, and can now be recommended with some confidence for planting pure blocks of single clones.

TABLE SHOWING YIELDS OF NETHERLANDS EAST INDIES AND MALAYAN CLONES
2nd JUNE, 1931.

Clone.	Where planted.	Date of Establishment.	No. of trees in test	Tapping Cut.	Yield in lbs. dry rubber per tree per 160 tappings for calendar year nearest to—									
					4 to 5 yrs	5 to 6 yrs	6 to 7 yrs	7 to 8 yrs	8 to 9 yrs	9 to 10 yrs	10 to 11 yrs	11 to 12 yrs	12 to 13 yrs	
JAVA.														
B.D. 5	Bodjong Datar	Feb. 1918	8	1/3										
B.D. 10	-do-	-do-	48	1/3										
Tj. 1	Tjirandji Estate	1920	2	1/4										
Tj. 16	-do-	1920	11	1/3										
SUMATRA.														
AVROS 49	Seed Garden, Polonia	Jul. 1919	4	1/3	36	7.6	11.5	12.7	12.2	15.3	20.8	25.0	24.3	27.0
AVROS 50	Seed Garden, Belawan	Jan 1919	9	1/3	2.5	5.2	10.7	12.0	10.4	11.0	18.5	18.7	18.7	18.9
AVROS 152	Boekit Maradja	Oct. 1922	100	1/3										
AVROS 185	Soengi Pantjoer	1922	4	1/3		7.8	12.6	14.0			27.5	23.9	31.6	
AVROS 214	-do-	Jan. 1924	10		5.5	9.4					21.3	21.8	18.0	
AVROS 256	Tamiang Estate	Oct. 1920	20	1/2				14.8	16.3	14.7				
MALAYA.														
S.R. 9	Kajang	Oct 1921	88	1/2			10.7	16.4	17.2	17.9				
P.B. 186	-do-	Apr 1922	261	1/2			11.9	16.0	20.5	27.9				
P.B. 23	-do-	-do-	63	1/2			13.7	16.2	17.8	20.7				
P.B. 180	-do-	-do-	211	1/2			12.2	13.5	14.5	23.2				
P.B. 86	-do-	Oct. 1923	250	1/2	10.6	12.5	15.0	18.4						
P.B. 123	-do-	June 1923	172	1/2		10.7	15.9	16.2	17.3					
P.B. 183	-do-	-do-	120	1/2		8.8	13.6	15.4	20.5					
G. 1	Glenshiel Estate	Dec. 1921	20	1/2			10.7	11.2	22.7					
R. 393	Rubana Estate	-do-	8	1/2			14.9	15.0	23.3	24.2				
S. 24	Sabrang Estate	Oct. 1921	18	1/2			12.6	20.6	19.8	22.6				

The yield of clone Sungei Reko 9 increased only slightly. Clone Prang Besar 186 continued its rapid increase in yield and gave the very satisfactory yield of 27.9 pounds in 160 tappings. These Prang Besar clones scattered together through the same area illustrate very well the difficulty of selecting clones at an early age. At 6—7 years, clones 186, 180 and 23 gave 11.9, 12.2 and 13.7 pounds, but when they were 9—10 years the order was reversed and their yields were 27.9, 23.2 and 20.7 pounds respectively. Clone 186 has steadily increased in yield, while clone 180 increased very little for two years and then made a sudden jump.

The yields of the other promising older Malayan clones Glenshiel 1, Rubana 393 and Sabrang 24 all increased slightly.

A few of the AVROS clones have now been test tapped in Malaya, but until records are available for all clones grown side by side, or grown in different places with the same standard clone, estates are still advised to make use of at least six or eight different clones, including the best from Malaya and from Netherlands India. Opinions have varied, however, as to the best policy to adopt in the use of a number of clones—whether to mix several clones in one area or to plant each clone in a separate block.

Systems of Planting Budded Rubber.

In August Mann⁽⁵⁾ published an article setting out in greater detail than before the pros and cons of three methods:—I. Block or Monoclone planting, II. Mixed planting of a number of clones, III. Mixed planted of one old with one younger clone, with the eventual object of cutting out one and leaving a pure block. The balance of argument is largely in favour of I or III through some planters still adhere to II, and the Proefstations of Java and Sumatra still appear to incline to mixed planting though they admit that large areas have been planted in pure blocks.

The main points in favour of monoclonal planting are ease of budding supervision and consequent economy, the even character of the stand with resultant uniformity of tapping, and the ability to tap each clone on the system most suited to it. If the clone for any reason proves a failure—falling off in yield, development of poor renewed bark or liability to disease—then the clone is cut out as a whole and complete replanting of the block can be carried out more satisfactorily.

Clones with a long tapping history, which includes a period of tapping on renewed bark, are suitable for monoclonal planting, but in practice clones that have given high yields up to about 10 years of age have been planted in blocks. In the clones that have been tapped on renewed bark there has been no reduction in yield, and it is practically certain that a clone with even and thick renewal will be safe. Younger clones are planted mixed, and still younger ones have been recommended for multiplication—longer records will be available by the time the budwood is ready for use.

In addition to the clones mentioned, the records of the Waringiana clones

in Java and Lampongiana clones in South Sumatra were published during the year, but though several of these have given very good yields they are scarcely available to the planter in Malaya owing to the imposition of a fee of 1,000 guilders for planting rights in addition to the cost of the budwood.

New Clones.

The search for new clones is being continued, and a number of estates have areas of their own buddings in tapping. Some of these are very promising—e.g. Pilmoor clone D. 65 gave 15.9 pounds in its 6th to 7th year, which is equal to the previous best record of a clone of its age. The Rubber Research Institute has established a clone trial area with buddings from 149 estate mother trees all of which had given a yield of at least five times the mean yield ($4\frac{1}{2}$) of the task in which they stand. New clones have also been established from over 700 seedlings obtained by hand pollination of the Pilmoor clones. Thus it is highly probably that in a few years we shall be planting still better clones with yields nearer to 30 than 20 pounds per tree at an age of ten years.

At present there is a choice of more than ten clones giving 20 pounds or more per tree per year at ten years old and so with this material, yields of 1,500 pounds per acre are certain and yields of 2,000 pounds quite in the realm of practical possibility.

Selection of Clones Suitable to Special Conditions.

There has been a tendency to ask for recommendations of special clones suited to special environments. So far such information is not available as there are very few areas of buddings in tapping away from their estate of origin. A start has, however, been made by the Rubber Research Institute in the collection of growth records of the well-known clones from estates with varied conditions of soil and climate. Analysis of these figures may enable us to say that a certain clone grows well in laterite soils but not in peat, or other type of soil, though generalisations may be difficult owing to the part played by the vigour of the stock in influencing the vigour of the budding.

Susceptibility to Damage and Disease.

During the year there has been shown some interest in the liability of certain clones to damage and disease. One of the reasons for the dropping of clone AVROS 80 from the planting programme was its liability to pink disease, and several Managers have shown an inclination to make use of their supplies of this clone in districts where pink disease is unknown. If the yield of this clone was still equal to other AVROS clones this would probably be a sound view and with block planting the control of such a disease would be relatively easy.

On two or three estates the attacks of grasshoppers have been confined to clone AVROS 152. In one hilly area in Pahang, planted with a mixture of about ten clones, this was very striking towards the tops of the hills and on the

sunny slopes. Walking through a heavy cover as many as twenty grasshoppers were often in the air at the same time, they rested on the leaves and stems of AVROS 152 rather than on other clones; and most plants of this clone had their leaves eaten, and some were completely defoliated. In the worst areas, unbudded seedlings and other clones were just showing signs of attack several weeks after the first observation of damage to clone AVROS 152. In areas where grasshoppers are abundant, this selective feeding may be serious and sufficient to bar the planting of their favourite clone, but many and large areas of this clone have grown successfully without damage so it is probable that the trouble is strictly local and not sufficient to justify a general recommendation not to plant this clone.

Another type of trouble is the liability of certain clones to wind damage. This is well known in clone AVROS 36, which suffered severely in Sumatra and was dropped from the list of recommended clones. It is interesting to note, however, that this trouble has not been reported in Java. This year, especially with buddings on big stocks, there has been trouble with the breaking of bud shoots a few months old at or near the union, or at a height of several feet on rather older plants. This has occurred largely in exposed situations during wind storms. There has been a suggestion that clone Sungei Reko 9 is rather liable to such breakage, but at present we have not collected sufficient evidence to assess this liability. This clone is a very vigorous grower and it is probable that breakage is connected with a tendency to softness of wood, though the mature trees have not suffered. It is likely that with closer planting sufficient plants would escape damage to leave a good final stand.

Technique of Budding

As the evidence in favour of budding has accumulated, many companies have made late decisions to bud, and consequently a good deal of attention has been given to the technique of budding seedlings 3, 4 and 5 years old. On the whole, budding-coolies have adapted themselves to the necessary modifications in technique and have obtained very good success. The main difficulties with budding on older stock lie in the after-care—treatment of the snags and pruning. Instructions for the treatment of pruned surfaces were published by Sharples and Mann. (7) The chief points are immediate treatment of the cut surface with a disinfectant followed by an application of an asphalt-kerosene mixture on the next day to prevent the entrance of die-back fungi, which might kill the stock to below the level of the bud. When the bud shoot is well established and showing brown wood at the base and there is a definite ridge between the growing stock and the dead snag, the snag is cut back just to the rim of live tissue and the new cut treated as before. After this, callus formation over the cut surface should start fairly rapidly.

If the bark of large stocks will not strip near the ground, budding can be carried out higher up. The cylindrical trunks of buddings give room for a long panel and the yields from high cuts are but little less than from low ones. Ever

if the tapping cut comes down on to the stock, better yields can be expected than from unbudded seedlings. When this recommendation of the possibility of high budding was first made by Mann there was available evidence from a small experiment by Dr. Cramer in Java and from a large scale experiment in Sumatra, which showed that the yields from seedling stocks budded high with scions of good clones were definitely higher than the yields of unbudded seedlings of comparable origin. In the last few months other papers have been published (1 & 2) relating to several experiments in Java which confirm the results of the earlier experiments.

Uniformity.

Uniformity of habit and performance has generally been regarded as an important attribute of the trees of a single clone and the variability of buddings within a single clone has received attention. The coefficient of variability of yield is of the order of 25 per cent. of the mean, so that there is a considerable difference between the yields of the best and of the worst trees in a clone. The best may be 75 per cent. greater and the worst 75 per cent. less than the mean. Thus, although the variability is considerably less than for seedlings, a clone is still far from uniform. It was found for the Pilmoor clones that there is a very close correlation between girth and yield within a clone (4). This has been confirmed by Van der Hoop in Java (3) for clones on Wangoenredja Estate, though Wenniger (8) states that in a clone Djasinga 1 there is no such correlation. However, for the Pilmoor clones the correlation is so close that in one clone a rogue tree was discovered from its unusual position in the correlation table, and Van der Hoop also found that one of his clones was mixed from a forked scatter of the points in the table. Both of these observations were subsequently confirmed by a study of seed and leaf characters.

Thus, with close planting in a block of one clone, the smallest trees can be removed with the certainty that they are the poorest yielders, and the resulting stand will be more uniform.

The vigour of the stock greatly influences the vigour of a budding and greater uniformity can be obtained by more careful selection of only the best stocks for budding. Small plants can be budded successfully, but it is false economy to 'squeeze' a nursery as this will result in a large proportion of weakly buddings and fewer trees will be ready for tapping at an early age. For budding in the field, several seedlings should be planted to each hole and the most vigorous budded.

At present the records of many clones are based on only a few trees, but there are enough clones with one or two hundred trees in tapping as well as mixed areas of older clones in Sumatra to justify the conviction that the yields from areas of buddings will equal those from the original trees of the same clones, especially if due care is taken to achieve ultimate uniformity in a complete stand.

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MANURING OF RUBBER TREES.

Review of Progress in 1931

BY

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The course of events in recent years has led to a very distinct cleavage between the scientific and economic sides of the question of manuring rubber. While it remains just as important as ever to gain knowledge based upon adequate field evidence, the question of monetary return has undergone a complete change of aspect. The relative position between the price of fertilisers and the price of rubber has changed so adversely that the increase in yield of rubber required to balance the cost of a fertiliser treatment is now several times as great as it was two or three years ago. However much this consideration may limit the possible application of the method it should not be allowed to interfere with the continued conduct of experiments already laid down. The cost of these must be regarded, not as an investment for monetary return, but as the purchase price of definite knowledge on an important subject

The year 1931 has been marked chiefly by the publication of summaries of results of manuring experiments both in Malaya and in Java*. In October J. S. Vollema published complete details of over forty experiments conducted in West Java. These experiments date back to 1926 and cover a wide range of fertilisers, namely,

Sulphate of ammonia 32

Chilean Nitrate 8

Urea 6

Calcium cyanamide 7

Seed cake 1

Double superphosphate 20

Basic slag 1

Leunaphos 5

Nitrophoska 4

Ephosphosphate 1

Sulphate of potash 12

Chloride of potash 8

Lime 8

Bonemeal 1

Diammonphos 5

Ammophos 20/20 2

Fish guano 2

Potash-magnesium sulphate 1

Some of the experiments concerned growth measurements in nurseries and young rubber, but most of them were conducted as yield tests on mature rubber. Taken as a whole, the results were fairly consistent in giving small increases, but these were not of high statistical significance. Very few gave marked increases even after a number of years. The numerical data are given in the paper in some detail, including analysis figures for many of the soils. The author summarises the results as follows:—

* *Archief voor de Rubbercultuur*, 15 No. 10; the paper being No. 69 in the series *Mededeelingen van het Proefstation voor Rubber*

Seedlings. Nitrogen and phosphate gave about 5 per cent. increase in height separately, and between 5 and 10 per cent. together. Potash alone gave no effect in the three cases tested. From 10 to 20 g. (20 g. = $\frac{1}{2}$ oz.) per plant was a suitable amount of fertiliser.

Young or poorly developed trees; height measurements.

POSITIVE RESULT.

<i>Fertiliser.</i>	Number of Expts.	Increase (height) over control.	Dubious (1) (negative)	No Effect.
Nitrogen	2	6—10 per cent.	(1) (negative)	7
Phosphate	1	About 10 per cent.	—	5
Potash	4	5—30 per cent.	—	1
Lime	—	—	—	1
Nitrogen & phosphate	4	5—20 per cent.	—	—
Nitrogen + phosphate + lime	1	About 25 per cent.	—	—
<i>Mature rubber, yields</i>				

POSITIVE RESULT.

<i>Fertiliser.</i>	Number of Expts	Increase over Control.	Dubious Number of Expts.	No Effect
Nitrogen	11	5—25 per cent.	5	9
Phosphate	2	5—10 per cent.	2	10
Potash	1	About 5 per cent.	—	9
Lime	1	About 5 per cent.	1	3
Magnesium	—	—	—	1
N + P	1	—	—	1
N + P + K	1	—	3	—
N + P + K + lime	—	—	1	1

Nitrogen gave the best results but only four experiments (on laterite soil) gave yield increases of really effective amount (15-25 per cent.)

Two lbs. of sulphate of ammonia per tree given every year showed no advantage over 4 lb. given in alternate years. It was found most advantageous to apply the fertilisers in the wet season and not in the dry. Here it should be remarked that Java has a much more pronounced and prolonged dry season than Malaya. The wintering of the trees is not followed quickly by rains, as it is in Malaya.

The author makes some interesting comments on the question of the soil analyses. In the height measurements on young rubber the average nitrogen content of the soil was lower for those cases where nitrogen was effective, but it was not possible to set a limiting figure on which to base recommendations. Phosphoric acid values of the soil were not connected with the effect of phosphates on the plants. As regards yields there was no connection at all between

the soil analysis figures (including both total and available phosphates) and the effects produced by fertilisers. This statement should help to dispel the belief, still prevalent in planting circles, that a laboratory analysis of soil should form an adequate basis for recommendations on manuring of rubber.

The final conclusions reached from the experiments were that manuring of nurseries was very serviceable, especially on poorer sites. Young rubber could also be brought into earlier bearing in an effective manner, which would offer profitable return for superior (budded) material on poor soil. Manuring of old rubber was not economic even in the best cases, and the only ultimate prospect for these areas was considered to be replanting with budded material.

The paper covering the Malayan data was published in the same month as the Java paper*. The authors do not attempt to give details of all the experiments examined, but take typical cases for discussion to bring out the differences encountered. The general conclusions support the Java conclusions, though the authors are more inclined to suspend such definite judgment in view of the shorter time which most of the experiments had run. Also a few exceptional cases occurred where the improvement in yield was much higher than in any of the Java experiments. The paper emphasises all through the paramount importance of the nitrogen question. However doubtful may be the economic benefits from the addition of nitrogen at the present stage, there can be no doubt that the deficiency in this regard in the past is the cause of most of the troubles (deterioration) experienced. The view is put forward that more rational methods of soil management may in the future maintain natural nitrogen supplies at a sufficient level.

Another summary of Malayan results was published in the Annual Report of the Rubber Research Institute for 1930. Out of 100 cases of manuring which were reported in answer to a questionnaire, 13 showed "considerable yield increase" and 20 showed a small yield increase, while 26 showed vegetative response only and 17 no response at all.

Experience has shown the particular importance of proper nutrition of plants during their earlier stages. It is often impossible to make good afterwards the injury that may have been done. It is therefore important to include considerations of manuring in any programme for replanting old areas.

An experiment known as Block 6 at the Rubber Research Institute Experiment Station is worthy of note because its layout is sufficiently elaborate to meet the demands of modern statistical analysis. The design is a Latin square of 36 plots of one acre each. During 1931 the published reports on this block reached the fourth series of measurements. The soil is virgin and the trees as yet less than three years old. The results from all manures have been very small, the largest being from the use of dung. The experiment has shown the unusually small standard error of 1.6 per cent., but this is not so surprising when it is remembered that the figure for each plot is the mean of some 80 measurements of distinct units.

*W. B. Haines and C. F. Flint, R.R.I. Journal, Vol. 3, No. 2.

DISEASES OF RUBBER

BY

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The four most important diseases of rubber in Malaya at the present date may be listed as follows.

- (a) Wet-Root Rot, caused by *Ganoderma pseudoferreum* (Wakef) Van O. et S.
- (b) Root disease caused by *Fomes lignosus*. Klotosch.
- (c) Mouldy Rot of the tapping panel caused by *Sphaeronema fimbriatum* (E. et H.) Sacc.
- (d) Leaf disease caused by *Oidium Heveae*. n.s.

Investigations into (a), (b) and (c) have been pursued vigorously during 1931 and much progress can be reported in all three lines of work. The investigation projected under (d) did not materialise partly owing to the failure of the development of an *Oidium* attack and partly to the fact that the officer in charge of this work had to depart on leave to England on medical grounds.

Root disease (Wet-Root Rot) caused by *Ganoderma pseudoferreum* (Wakef) Van O. et S.

The fungus causing Wet-Root Rot, the most prominent root disease in old rubber plantations in Malaya, is commonly known locally by two other different names, and much confusion often arises as a result. *Poria* disease and *Fomes pseudoferreus*, are the two names by which the fungus causing Wet-Root Rot disease is most commonly known, but the correct scientific name for the fungus is *Ganoderma pseudoferreum*, the other names being synonyms.

The constant loss of stand, with a large decline in yield per acre, as a result of the ravages of this root disease in old rubber areas is now being clearly recognised in Malaya, and many estates have reached the position where quite large acreages have had to be abandoned because these acreages have become uneconomic units under the present conditions, owing largely to root disease losses. This fact has stimulated great interest in replanting and rejuvenating schemes with a view to supplying these areas with high-yielding bud-grafted material, and a long list of estates can be given on which this work is being undertaken.

A special bulletin, No. 3, of the Rubber Research Institute of Malaya was published in November 1931 in which the whole subject was dealt with in a comprehensive manner. The records obtained by complete root exposure methods showed that 56—60 per cent. of trees with diseased roots were to be found in diseased areas and that in 30 per cent. of the diseased trees the fungus was found only in the smaller lateral roots, and would most probably be missed if only a partial root exposure, 4—6 ft. in diameter around the stem was undertaken. This suggestion is supported by recent work in areas being felled for the pur-

pose of replanting. In such areas, where the trees are roughly removed by jacks, the number of obviously diseased trees usually totals over 20 per cent. There must be a fair percentage of recently affected trees with the disease present in the smaller lateral roots only, which cannot be tallied easily by this rough and ready method and there is no doubt, in the writer's opinion, that the root disease percentage in these areas is usually nearly 50 per cent. Badly diseased areas of $\frac{1}{4}$ of an acre in extent have been worked over which showed a root disease percentage of over 90 per cent. Similar experiences have been reported from Sumatra.

Several important new findings were made during 1931 which it is hoped to follow up during 1932, if opportunity permits. The most important finding is the discovery of this disease in trees not over $3\frac{1}{2}$ years old and the characteristic response of vigorous roots, even in young trees, to the fungus attack. This response is the development of large numbers of adventitious roots from the healthy portions of the root which have not been reached by the intruding fungus. The production of masses of adventitious roots by the large roots of old trees is a very common feature and it occurred to the writer that therein lay the clue to two peculiar features of this disease. These features are:—

(a) The disease did not become prominent before the 8th—10th year.

(b) The best looking and best yielding trees were the first to be attacked.

The lateral roots of a tree $5\frac{1}{2}$ years of age were found attacked, and the response was found to be similar to that in older trees, the attacked roots producing a large number of adventitious roots; the actual result therefore, from the time of infection onwards, is an increase in area of the absorbing portion of the root system. This goes on progressively, the increase in absorbing area due to the development of adventitious roots being reflected in better leaf canopy development and later on, when tapping is commenced, in higher yields. This position is maintained until the fungus has affected so much of the root system that absorption cannot be maintained at the usual rate. This will happen when the fungus has travelled up one or two of the main laterals and passed into the stem. Because of the reduced rate of absorption the tree begins to show signs of disease in the upper branches and when the roots are carefully inspected the typical Wet-Root symptoms can usually be found.

The writer holds the opinion that Wet-Root rot disease will probably be found in the very early history of new plantations, in the near future. This is a most important finding as it demonstrates that adequate control is not likely to be obtained unless systematic measures against this disease are put into operation in the earliest stages of the plantations.*

The most important factor influencing the spread of Wet-Root rot is careless or unscientific thinning-out. In all the worst cases, the trees have been cut at ground level, the stem and branches removed while the tap root and laterals

*During a recent tree-to-tree root inspection over an area of 40 acres with trees $3\frac{1}{2}$ years old, ten undoubted cases of "Wet-Rot" caused by *Ganoderma pseudoferreum* were found.

are allowed to rot *in situ*. This system provides ideal conditions for a disease which spreads by direct root contact. Due regard to this fact must be paid in any future policy which depends on the establishment and maintenance of high yielding areas of bud-grafted rubber and one of the important guiding lines in such a policy must be a minimum amount of thinning-out of trees; if any thinning-out is undertaken it is essential that tap-roots and lateral roots be taken out as completely as possible if the position with regard to Wet-Root rot is to be improved in the developing plantations of the future.

Root Disease caused by *Fomes lignosus*: Klotzsch.

Many unexpected results have been obtained over the last year in the investigation of this disease, and these results necessitate full confirmation on a larger scale. The legitimate deductions to be made from these experiments at the present date are :—

- (a) Up to an age of three years, rubber trees are exposed to a greater risk of infection from *Fomes lignosus* in an area from which surface timber and jungle stumps have been removed than in an uncleared area.
- (b) It is probable that the incidence of the disease in a young clearing is less under a cover crop than in clean weeded areas.
- (c) Up to the age of three years the incidence of the disease on rubber trees is probably least where secondary jungle has been allowed to grow up, as a natural cover.
- (d) Application of lime encourages the growth of the fungus.
- (e) An aqueous solution of copper sulphate at a 2 per cent. strength is able to kill superficial mycelium upon the roots of rubber trees if it comes into direct contact with the mycelium.
- (f) It has been found that fructifications of *F. lignosus* spore freely at certain seasons which probably occur after periods of heavy and continuous rain.
- (g) The mycelia isolated in pure culture from (i) the fructifications (ii) the rhizomorphs (iii) from diseased wood are identical in microscopical vegetative characters, but that from spore cultures, has a slower growth rate and produces more aerial mycelium on nutritive media.
- (h) Rhizomorphs and fructifications can be obtained under experimental condition in the laboratory from naturally infected material. The most profuse rhizomorph formation takes place in the absence of light; when exposed to light there is a tendency to form fructifications. Fructifications developed in the laboratory can produce spores even in the very early stages of development.

Mouldy Rot caused by *Sphaeronema fimbriatum* (E & H) Sacc.

Up-to-date there are many gaps in our knowledge in relation to Mouldy Rot disease. There is no doubt that it is the most serious above-ground disease

of the rubber tree in Malaya, and the situation in native holdings with regard to this disease is extremely unsatisfactory.

In addition to *Sphaeronema fimbriatum*, there are two other species of the same family found on rubber trees. Investigations have shown that the "*Sphaeronema pycnidium*" is not always an imperfect fruit-body containing pycnosporos but is sometimes a perfect fruit body containing ascospores and thus some of the *Sphaeronema* species have been wrongly named and should now be placed in the genus *Ceratostomella*. This finding has been confirmed with one of the rubber *Sphaeronema* species though not as yet with the species causing Mouldy Rot. However, it is fairly certain that a similar finding will be made with the fungus causing Mouldy Rot. Pure cultures have been obtained and when the required fructifications develop an attempt will be made finally to confirm the status of the Mouldy Rot fungus. In addition, an attempt will be made to fill in some of the existing gaps in relation to the method of infection and host-parasite relationships.

During August last, arrangements were finally completed for running systematic tests on various proprietary disinfectants which might prove useful in the control of Mouldy Rot. The terms of testing were set out with a view to establishing a "White List". The work has been carried on successfully over the last three months and many substantial facts have been obtained as a result. Three additional disinfectants have successfully passed the required tests and several more remain to be tested.

Recent investigations have revealed certain interesting pointers in the matter of treatment. The usual Mouldy Rot symptoms have been found to disappear very rapidly during a spell of dry weather; after three days, without rain but with bright sunshine, a block of trees with 60 per cent. of the trees infected showed practically no signs of the fungus on the tapping panel. It is obvious from this result, that field tests cannot possibly be continued during dry-weather periods. A definite endeavour should be made to clear bad Mouldy Rot areas during dry-weather periods; if this could be done it is probable that control of the disease during the wetter months of the year would be rendered easier and less expensive.

The question of periodic tapping is of some importance in areas badly infected with Mouldy Rot. A fundamental point in the standard treatment of Mouldy Rot is the cessation of tapping for one month. Thus, if an alternate monthly system of tapping was arranged, there should be little difficulty in controlling Mouldy Rot, even in badly infected areas. This has been adopted on one estate and slightly infected trees are painted over the recently tapped surface with Lime Wash. There is no doubt that a great improvement has been effected by this method.

Again, the A.B.C. system of tapping can often be arranged to help in control of Mouldy Rot where an estate is bordered with small Asiatic holdings containing rubber trees badly infected with Mouldy Rot. September to December are the months during which Mouldy Rot spreads rapidly, because of the more constant rainfall

during this period of the year. Therefore, during this period, the tapping on the A.B.C. system should be arranged so that the trees nearest the badly infected small-holdings areas should be out of tapping during the September—December period. By taking advantage of this suggestion, one estate has cut down expenses on Mouldy Rot treatment very extensively.

The special feature in relation to this disease was an arrangement agreed to by the Department of Agriculture to supply planters with disinfectant for the treatment of Mouldy Rot in small-holdings adjacent to their estate; they in turn agreed to supervise the correct mixing. Such an arrangement would help considerably in the control of the disease if it can be worked successfully.

The enforcement of the regulations of the "Pest and Diseases Enactment" is difficult during depressed periods such as the present for the small-holder is forced to tap continuously in order to obtain money for food. But attention must be drawn to the present anomalous position which has now arisen. Owing to lack of funds little or no attention to treatment of the disease is being given on small holdings. Under such circumstances the "bark position" on infected small holdings goes from bad to worse and an endeavour has been made to improve the condition of the bark by frequent paintings with weak disinfectant solutions, after tapping has been done. Even if painting with a weak disinfectant solution is done faithfully after each tapping, the fungus is not prevented from further development for if painting is stopped for two to three days, the fungus becomes prominent again on all the trees previously affected. After much consideration, the writer is doubtful whether the bark position is improved or not, but the loss of control of the fungus which will result from the adoption of these methods is bound to lead to misunderstanding. From a pathological point of view such control measures cannot be recommended, and the dangers of the situation are all too obvious to those estates which have not yet been troubled by Mouldy Rot disease.

Further Research Items.

The following list gives the varied subjects which have come under review recently and to which additional observations of interest have been made.

- (a) Lightning injury on rubber plantations.
- (b) Bud-grafting on old stocks and protection of pruned surfaces with Asphaltum-Kerosene mixtures.
- (c) Host-parasite anatomical relationships in *Ganoderma pseudoferricum* (Wakef.) Van O et S. and *Sphaerostible repens* B & Br
- (d) Internal Bark fissures.
- (a) Lightning in relation to diseases of rubber trees has been considered of relative unimportance up-to-date. As a result of many years work the writer has shown that lightning is probably the most important primary agent of disease in coconut plantations in Malaya and it seemed possible that lightning effects might be of some importance in relation to rubber tree diseases.

Investigations made during the year have proved conclusively the soundness of this view. Lightning effects in rubber plantations are quite definite and can be considered conveniently under two headings.

- (i) Lightning effects in young plantations associated with "Die-back".
- (ii) Lightning effects in older rubber, (over four years), associated with Claret-Coloured Bark Canker at the collar.

The general features associated with (a) have been referred to on previous occasions by other investigators but no exact data have been forthcoming. The association of Claret-Coloured Bark Canker at the collar with lightning effects, is an entirely new departure and has not been recorded previously. A comprehensive article on lightning effects and diseases in coconut and rubber plantations is ready and has been submitted for publication. The subject matter is of considerable scientific interest because of new findings which lead to clarification of obscure views.

(b) There are few difficulties attached to the practice of bud-grafting if the stocks are not more than 18 months old. Difficulties arise, however, when well grown stocks, over 2½ years of age, are used, because when the stock is cut back a large wood surface is exposed. Budding on trees four to five years old has been common during the past year or two and when the large stocks are cut back a wood surface of large dimensions is exposed which will take years to close over naturally by callus formation, and unless great care is taken "Die-back" fungi gain an entry and grow downwards to a level below that of the Bud-Patch. Cases have been found where the "Die-back" fungi had penetrated to ground-level and there is no doubt that such cases must succumb finally. The trouble occurred on such a large number of estates that it was considered necessary to issue "Standard Instructions for protection of the pruned surface".

In connection with the budding operation Asphaltum and Kerosene mixtures are the standard recommendation for covering the pruned surface. It has been definitely proved that the Asphaltum-Kerosene mixtures are not ideal covers for this purpose. *Diplodia* pycnidia have been demonstrated actually developing in the interior of the Asphaltum-Kerosene layer covering the pruned surfaces. However, this still remains the most useful cover, more especially if used in conjunction with a strong disinfectant solution which should be painted over the exposed surface a few hours before the application of the Asphaltum-Kerosene mixture. Further experiments will be carried on to obtain a better cover if possible.

(c) The difficulty of correct diagnosis has been experienced by all plant pathologists working on perennial crops. The early symptoms of root diseases of rubber trees are often very difficult to identify correctly and definite aids to correct diagnosis would be welcomed. Microscopical sections of the bark tissue of the roots rubber trees attacked by *Fomes pseudoferreus* Wakef. and *Sphaeros-thiбе repens* B & Br. show typical appearances by means of which a correct diagnosis can be made. These observations will be published when opportunity offers.

(d) This particular affection of internal fissures was first noted in Malaya in 1929 and attention was drawn to the apparent similarity of the symptoms with Black Stripe disease. Several cases have been examined during the year and they were all found under exactly similar conditions. The estates on which the symptoms were found had poor bark reserves on their old trees and for this reason tapping had been commenced on previously untapped bark, 18 inches to 2 feet above the bark panel which had been tapped for many years past. The symptoms became noticeable in two months' time on the newly opened panels. The explanation is still obscure, but the discovery of this association should prove of value if an opportunity for further investigation presents itself.

Other Diseases.

Pink disease was troublesome in some parts of North Perak and Kedah during the first half of the year. Black Stripe and Brown Bast were of little account. The root diseases caused by *U. Zonata* and *Sphaerostilbe repens* were of the usual order and call for no comment. The expected Oidium attack failed to develop owing to weather conditions, unfavourable to the fungus, prevailing during the year. Consequently, a comprehensive scheme of sulphur dusting experiments, which had been arranged during the months of January and February, had to be abandoned.

This article deals primarily with rubber tree diseases but this opportunity should not be missed of drawing attention to a cockchafer grub plague which is under investigation on one estate in Malaya. The occurrence of this grub plague has, fortunately, been confined to an area of less than 100 acres in extent, of 14 year old rubber. The presence of the grubs was first reported in August 1930. These grubs have been known to attack seedling rubber plants on a small scale but there is no previous record of a mass attack on mature rubber where thousand of grubs have been removed from the soil without any apparent decrease in numbers. The grubs eat away the cortical tissues of the tap and lateral roots down to the wood and a badly attacked tree undergoes successive defoliations with a resulting decrease in yield. The problem is one of great entomological interest and is being closely followed up.

THE MALAYAN RUBBER INDUSTRY IN 1931

BY

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The following general review of the condition of the Rubber Industry has been prepared from material compiled for the Annual Report on Agriculture in Malaya.

The sale price of rubber during 1931 reached a new low level, the average price for first grade smoked sheet being 3.13d. in London, 6.07 cents (gold) in New York, and 9.78 cents (Straits) in Singapore. The rise in price shewn in the London and Singapore markets during the last three months is due to the British departure from the gold standard.

The majority of estates steadily reduced the cost of production by means of rigorous economy, but this was followed by further falls in price, so that at the end of the year only a comparatively small number of estates could show a favourable balance.

Notwithstanding this pressure, up to the end of the year only a comparatively few large estates had ceased production, and the effect of the low prices in reducing production has been slow. A large number of estates only maintained production in the hope that shortly the situation might be relieved by the introduction of restriction in some form.

Year	World Production Tons	World Consumption Tons	World Stocks* Tons	Average Price s. d.
1922	379,920	394,527	205,840	0 9½
1923	412,771	439,407	163,097	1 3½
1924	421,217	458,252	108,950	1 1½
1925	516,076	551,244	76,383	2 10½
1926	614,778	533,915	149,026	1 11½
1927	605,196	589,128	193,146	1 4½
1928	649,674	667,027	122,828	0 10 11/16
1929	863,410	785,475	228,572	0 10½
1930	821,815	684,993	366,034	0 5 1 5/16
1931	799,000†	673,000‡	556,075§	3 8

* Total of stocks at three main centres—U.S.A., United Kingdom, and Singapore and Penang.

† Vide Rubber Growers' Association Bulletin, February, 1932

‡ Estimated world absorption of crude rubber by manufacturers, (Rubber Growers' Association Bulletin, February, 1932, page 103).

§ Total of stocks on hand and afloat for the three main centres—U.S.A., United Kingdom, Singapore and Penang (Rubber Age, February 10, 1932). The total stocks on hand and afloat in the world are estimated at 629,276 tons.

With consumption dropping sharply during the industrial depression, world stocks have risen in 1931. The situation which rubber shares with so many other commodities, but in more acute form than most, is shewn in the above statistical summaries taken from W. H. Rickinson and Sons' "World Rubber Position, 1931".

Areas Under Rubber in Malaya.

The total area under rubber in Malaya at the end of 1931 was approximately 3,070,000 acres.

Rubber Production in Malaya.

The production of rubber in Malaya for the year 1931 is estimated to be 434,857 tons. Of this total 239,435 tons represent the production on estates of 100 acres and over and 195,422 tons the production of holdings less than 100 acres. At the average export price per ton of \$227.75 the total value is \$99,038,682. The production is sub-divided as under :—

	Production of estate over 100 acres.	Production of estates under 100 acres.
Federated Malay States ...	141,457 tons	105,378 tons
Straits Settlements ...	24,766 „	25,346 „
Unfederated Malay States ...	173,212 „	63,698 „
	239,435 „	195,422 „

New Plantings in 1931.

The area of new planting is estimated to be as follows :—

Federated Malay States ...	8,307 acres.
Straits Settlements ...	822 „
Unfederated Malay States (Information not available).	

In pursuance of the decision reached in 1930, no fresh alienations of land have been made, consequently additions to the planted areas so far as is known have since that date only occurred on land previously alienated.

Conditions on Estates.

Slump conditions have undoubtedly retarded progress on many estates in relation to budding programmes, replanting schemes and amelioration of soil conditions, especially in the application of fertilisers. Except in a few instances, estates have been well maintained, and crop yields have shown little or no sign of diminution. As is to be expected, increasing attention has been paid to the possibility of making economies in production, and this has been particularly

marked in factory practice in which considerable economies have been found possible particularly in relation to the manufacture of smoked sheet rubber.

Tapping costs have also been considerably reduced on many estates. In 1930 it was stated that it had been possible to produce crops at the low F.O.B. cost of 10—12 cents. During 1931 these costs have been almost halved on many estates, although it must be admitted that little or no allowance has been made for improvements in general estate practice, while profits are nil.

Experimental work in progress on several estates had to be stopped, while it is not possible for estates contemplating manuring programmes to initiate experimental work. A number of experiments have, however, been laid down by Imperial Chemical Industries and Malayan Fertilisers Limited.

A comprehensive article by the Soils Division of the Rubber Research Institute shows that, generally, the manuring of well-grown rubber trees having a yield of above 400 lbs. of rubber per acre usually gives no notable increase of crop, while it is common to obtain useful increases on areas yielding between 200 and 300 lbs. of rubber per acre.

In the case of trees having poor foliage and bad bark, considerable improvement of both foliage and bark has been observed as the result of manuring, but yield increases have been considerably delayed in appearing. The results indicate that the trees have a definite optimum yield which is not materially increased by the application of fertilisers, so that response is only obtained when the yields are below this optimum.

Increased attention has been paid to soil conservation by the cultivation of leguminous and other cover crops and to mechanical methods of preventing soil erosion. The growth of cover crops under rubber has continued steadily to extend, while practice in relation to the prevention of soil erosion by other means such as silt pitting, contour draining and so forth has greatly advanced in the last few years. On well managed properties the situation in relation to the prevention of soil losses by erosion may be regarded as moderately satisfactory.

Forestry Method of Cultivation.

Interest was aroused during the year in the so-called forestry method of cultivation of rubber due particularly to the pioneer work of one estate in Pahang. The principle underlying this method is to allow spontaneous growth, consisting very largely of *Hevea* seedlings mixed with other forms of natural growth, to grow up unchecked amongst the rubber trees. It is claimed that this type of growth, while doing no harm to the main crop, conserves surface soil by preventing erosion, and lowers the temperature of the soil to a point such as exists under jungle conditions, and so lessens oxidation of organic matter in the soil. It is claimed that by this method conditions both of soils and trees on rubber estates can be greatly improved; in so far as concerns the latter the thesis apparently is that as rubber itself was originally a forest tree the introduction of forest conditions in its cultivation may be the correct procedure. It may be pointed out, however, that as all plants have their origin in some wild form, the

argument is logically capable of extension to any form of cultivation, although in the case of rubber there may be certain special factors which are particularly influenced by such conditions.

On the other hand, it would seem that a point may arise when competition from other forms of vegetation affects yields and growths and also gives rise to difficulties by hindering access. In general, the encouragement of natural covers on permanent cultivation is an interesting development. It seems arguable, however, whether the best results might not be likely to be secured by the periodic cutting back of the growth so engendered; it may be pointed out that this type of procedure was advocated so long ago as 1904 by the late Sir Francis Watts in relation to cocoa and lime cultivation in the West Indies. In any event, future developments along these lines will be watched with interest

Budding of Rubber.

Records of high yielding mother trees of various estates have been continued, and a large number of seedlings at the Rubber Research Experiment Station have been budded with budwood from these trees for the development of new Malayan clones.

Tapping has been continued on the Pilmoor Estate clones, while several methods of tapping have been applied to groups of trees from the very promising Malayan clone Glenshiel I.

Budding programmes have been continued on a number of estates although the slump has stopped such development in many cases. It is estimated at the end of 1931 there was a total area of over 134,000 acres of budded rubber in Malaya. Importations of budwood and superior planting material from the Netherlands East Indies and other outside sources are as follows:—

Budwood	...	6,039 metres
Special Seed	...	5,000

These show a considerable decrease on the figures of previous years due largely to the establishment of multiplication nurseries in Malaya and the increasing use of promising Malayan clones.

Mono-clone planting, i.e. the planting of single clones in blocks of a suitable area, continues to find favour.

Various experiments on different methods of budding and budding of older stocks at different heights have been continued at the Rubber Research Institute Experiment Station, while test tapping on young budded trees both at the Experiment Station and on several estates have been continued with the object of correlating the yields with subsequent systematic commercial tapping when the trees reach a tappable age.

Manufacture.

In relation to manufacture, it has been shown that considerable variability still exists in the product. The influence of the carbohydrate (sugar) consti-

tuents of latex has been investigated, and in addition to the isolation of quebra-chitol (1-methyl inositol) from the latex and its serum, investigations have been carried out on the properties of lipin isolated from latex by the Rubber Research Institute.

Increasing attention has been paid to improvements in factory machinery and equipment especially in the preparation of smoked sheet. As a result of the work of a number of estates, batteries of light sheeting machines in cascade or file formation, capable of outputs of from 2,000 to over 3,000 lbs. of dry rubber per hour have been developed and are in use on a number of estates.

The saving in capital costs and running expenses on large estates as a result of the investigation will be very considerable, since only a small factory with a battery of five or six light sheeting machines is sufficient for an area of 6,000 acres or more.

Improvements in the ventilation and design of smoke houses and smoke house fire boxes is also resulting in economies in consumption of wood fuel combined with more rapid drying and smoking.

The higher cost of preparation of thin pale crepe is tending to cause a reduction in the output of this grade, since the extra premium is not sufficient to cover the extra cost of manufacture, but it is anticipated that in due course it may be found possible to prepare a thin air-dried sheet as a substitute for thin pale crepe at about one-third the cost, so that heavy machinery in only a few central factories in each district will be required for treating the 10—15 per cent. of lower grade rubber.

The increase of export of preserved latex has continued and the extensive application which this form of product is finding in Europe and America leads one to expect that a rapidly increasing demand therefor will in due course ensue.

Small Holdings.

In view of the importance which attaches to production on small holdings as a factor influencing the total production of rubber in the East, interest in the question has continued to increase. Throughout the year regular surveys of the conditions on small holdings have been carried out by the Department of Agriculture and quarterly reports on the position of such holdings have been published in the *Malayan Agricultural Journal*. These reports are undertaken at the special request of the Rubber Growers' Association. The data collected by the Statistical Division of the Department of Agriculture and the Department of Statistics place the production in tons on small holdings for the last two years at the following figures :—

		1930	1931
Federated Malay States	...	110,206	105,378
Straits Settlements	...	38,770	25,346
Unfederated Malay States	...	66,113	63,698

It would thus be seen that the production on small holdings shows a slight diminution as compared with 1930, the decrease being most marked in the Straits Settlements and least in the Unfederated Malay States.

Although tapping on the share system was still common on small holdings, the number of owners who tapped their own trees increased steadily. Tapping was continuous and bark removal excessive on holdings of which the owners had no other source of livelihood.

Owing to the suggestion that on small holdings excessive tapping was the rule, proposals were put forward during 1930 for undertaking a regular survey in this respect. These proposals materialised during the year 1931 and a special grant of \$10,000 was made from the Rubber Research and Propaganda Fund for the purpose. By the end of the year these investigations had been carried sufficiently far to enable a certain number of deductions to be made therefrom; it was found that the consumption of bark on the small holdings examined was considerably less than had been anticipated. No reliable data are yet available on the subject of the ratio of bark consumption to bark renewal. Systems of measurements have been worked out and put into operation, but no figures can be supplied until a lapse of one year from the commencement of the work.

Some interesting data have become available in relation to planting distances on small holdings, which shows that out of a total of 35 holdings examined the distances ranged between 8 x 10 feet as a minimum up to 18 x 18 feet as a maximum.

Pests and Diseases.

No special outbreaks of disease have occurred during the year.

Mouldy Rot, caused by the fungus *Sphaeronema fimbriatum*, has, however, been very prevalent during the wet season on small holdings. The disease spread considerably owing to the migration of dismissed tappers from infected areas to other localities previously healthy. Its control, especially in the wetter weather, also proved difficult, since owners could not usually afford to cease tapping or even in many cases to purchase efficient disinfectants, although rendered available to them at cost price through the officers of the Department of Agriculture.

During the year, the Department of Agriculture in conjunction with the Rubber Research Institute of Malaya organised a scheme for the testing and official recognition of fungicides which could be safely used in the treatment of Mouldy Rot, and facilities were provided whereby owners or agents of different fungicides could have their preparations tested at the Rubber Research Institute; if the results of the test are satisfactory, the fungicides are included in a "white list." When prescribing treatment on holdings affected by Mouldy Rot the Department of Agriculture will enter on the notices served only the names of preparations which have been approved by test at the Rubber Research Institute and included in the "white list."

The incidence of leaf mildew disease caused by the fungus *Oidium Heveae* was negligible, probably owing to the regular rainfall after the normal wintering season, and on this account no further investigations were carried out on the control of this disease by the dusting of sulphur.

Considerable attention has been paid to the two principal root diseases—*Fomes lignosus* and *Ganoderma pseudoferreum* (*Fomes pseudoferreus*). A special bulletin was published by the Rubber Research Institute during the year dealing with the problem of root diseases in mature rubber, especially in relation to replanting of such areas with high yielding material which is considered to be an economic proposition. It is considered that the incidence of root diseases probably is the limiting factor to the life of plantations established on virgin jungle soils, and the economic life under such conditions has been placed by the Pathologist of the Rubber Research Institute at about 30 years.

During the year further investigations on *Fomes lignosus* have thrown new light on the occurrence of this disease. It has been shown that the treatment of the soil by liming is of no value, while treatments with certain fungicides, if direct contact of the fungicide with the mycelium on the plant is effected, is useful.

A grub or caterpillar of a cockchafer is reported as causing considerable damage on one estate; the disease is being investigated.

Helminthosporium Heveae (Bird's Eye Spot Disease) and Mites caused damage particularly to young plants and seedlings in nurseries, while grasshoppers have caused a certain amount of damage to young seedlings and budded plants. It is interesting to note that the latter appears to have shown particular preference for one clone only.

Conclusion.

The Rubber Industry of Malaya is passing through the most severe vicissitude which it has so far experienced, or probably is ever likely to experience.

Drastic retrenchment of expenditure and curtailment of development is in these circumstances inevitable. Nevertheless, progress is discernable in many directions and it seems reasonable to believe that when the industry does eventually emerge from its present difficulties, a standard of efficiency of production will have been shewn to be capable of achievement which was undreamt of in the prosperous times which formerly prevailed.

CONDITIONS OF SMALL RUBBER HOLDINGS IN MALAYA

First Quarter, 1932.

Rainfall.

In January the dry weather commenced earlier than usual with the exception of Kedah, where rain continued to fall until the middle of the month. High winds were experienced during January throughout the Peninsula, with occasional North-East winds in Selangor and Negri Sembilan. In the first half of February the rainfall was practically restricted to Perak North, where it was above the average, while in the latter portion of the month thunderstorms of varying frequency and intensity were experienced generally.

The first half of March was dry but the second half brought a heavy fall in Pahang, which occasioned somewhat severe flooding there and the precipitation was everywhere above normal.

Prices.

The following table shows the range of prices received by small-holders for rubber sold to local dealers, and for comparison with these, the average Singapore price for the month for standard sheet, together with the price quoted at the end of each month, in Singapore and Penang, by large dealers for small-holders' rubber. All quotations are given in Straits dollars and cents for the price per picul, i.e. 133½ lbs. The highest prices in January and possibly in February were the result of speculation by local buyers at the possible introduction of restriction.

It must be borne in mind when comparing the above figures, that the quotation for Singapore smoked sheet is the average monthly price, whereas other quotations give the range of prices over a number of buying centres. The following shows the range of prices in dollars per picul for smoked sheet in five of such centres in Negri Sembilan for the month of January.

Seremban \$10 to \$13.50	Port Dickson \$9.50 to \$11.50
Kuala Pilah \$10.50	Jelevu \$11 to \$14.
Rembau \$10 to \$13	

Tapping.

The customary decrease in tapping during the padi harvest season has been observed everywhere in padi-growing districts. In Perak, Selangor, Penang and Province Wellesley and Negri Sembilan there has been a general tendency to neglect rubber wherever owners have any alternative agricultural resources, particularly during the wintering period when the yields obtained have hardly justified tapping operations. Chinese and Chettiar-owned holdings of a larger size are still reported generally to be reducing the areas under tapping, and in several cases to be closing down entirely.

Table of Rubber Prices.
1st Quarter, 1932.

	Singapore Standard sheet Average	Singapore for small holder's rubber at end of month	Penang for small holder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
	(9.43 lbs)			JANUARY							
Smoked sheet.	12.57	11.80	11.20-13	11.25- 13.25	11-14	8-13	9-12.50	9.50-14	10-14	9.40- 12.30	8.50- 13.75
Unsmoked sheet.		10.50	9-10	11-12.25	8-12	8-11	7-10	7.50- 12.50	8-12	10.45- 13.20	6-11.50
Scrap		4	5-6	6-6.50	5-7	3-6	2-6	2-7	4-5	4-7	2-6
	(8.18 lbs)			FEBRUARY							
Smoked sheet	10.91	9.50	—	9.50- 10.50	9.50- 11-20	7-10	8-12.50	7-11	8-10	9-11.80	7- 10.30
Unsmoked sheet		8	8-9	8-11.50	7-10.50	6.50- 8	5-10	6-9.50	7-9	7-10	5-9
Scrap		2.50	4-5	5-6	2.50-7	2-4	2.50-5	2-6	3-5	—	1.50- 5.50
	(6.39 lbs)			MARCH							
Smoked sheet.	8.52	5.50	—	8-9.80	6-9	5-9	5-9	4-8.75	5-3	6.20- 11	4.20- 8.70
Unsmoked sheet.		3.75	5.30-6	6.75-8.50	5-8	4.50- 6.50	3.50-6	3-7.50	4-6.50	4-9.60	2- 7.50
Scrap		.60	2-3	4-5	2-4	1-3.50	1.50-4	1.50-4	2-4.50	1-6	1- 3.50

Reports from Selangor, Penang and Province Wellesley state that in cases where the owners are entirely dependant on rubber as a livelihood, somewhat excessive tapping has been observed in an effort to produce more rubber to counter-balance the low prices obtained.

The work of investigation on bark consumption is continuing.

Since the publication of the report for the fourth quarter of 1931, a further twenty-eight holdings have been brought under observation, bringing the total number of holdings on which monthly bark consumption measurements are now being taken up to ninety. The officer in charge of this work, who is at present engaged in taking measurements of the reserves of tappable bark on each plot, has been unable to prepare a further detailed report, but he states that no very marked alteration in the rate of bark consumption, or in the general position of affairs on these selected holdings has been observed.

Records of yields are taken each month on all the above small-holdings; it is not, of course, possible to publish figures of the average yield per acre per annum, which could be regarded as at all accurate, until a complete series of twelve monthly yields have been obtained. During the period of October to December 1931 yields per acre per month ranged between 28 lbs. per acre and 123 lbs. per acre.

Postponement or Acceleration of Bringing Young Rubber into Tapping.

The position with regard to this remains unchanged throughout the Peninsula during this quarter; practically no young rubber was brought into tapping.

Root Diseases.—Above-ground observations are made by the Bark Recorder of all trees on which bark measurements are being taken: he reports that out of a total of 8,300 trees examined by him in lots of 100 consecutive trees on 83 widely distributed holdings, 49 cases of root disease were found as follows:—33 cases of *Ustulina Zonata*, 4 cases of *Ganoderma pseudoferreum*, 11 cases *Fomes lignosus*, and 1 case of *Sphaerostilbe repens*, making an average incidence of 0.59 per cent.

Mouldy Rot.—The dry weather during the wintering season caused the usual decrease in infection, which was, of course, materially aided by the circumstance of many holdings being untapped during this quarter.

Oidium Heveae.—Sporadic outbreaks of this disease have been observed in Muar, Batu Pahat and Segamat in Johore and at Umbei and Serkam in Malacca: the onset of the rains in the middle of March has been responsible for an immediate decrease in its incidence in all these areas. *Oidium Heveae* has been observed to attack both the flowers and young leaves in practically all rubber areas in Province Wellesley and was reported for the first time at Penang Island.

Budgrafting.

So far the only instance of budgrafting reported among small-holders, is that of an area of nine acres of budded rubber owned by a Chinese in Negri Sembilan.

Grades of Rubber Made.

Marketing methods have remained practically unchanged during this quarter; unsmoked sheet still appears to be the most popular form of rubber sold by small-holders, more especially by the Malays. Owing to the necessity for obtaining ready money, it is the prevailing custom to sell this unsmoked sheet in this form one to three days after harvesting; the dealers frequently pay a small advance on this, making the final payment only after the sheet has been completely smoked by them. A reduction is, of course, made to cover the cost of smoking.

The preparation of slab rubber in large quantities is still practically confined to the districts of Krian and Taiping in North Perak and to Kuala Langat in Selangor: in the latter District about 12 per cent. of the total small-holders' rubber is now sold in this form. The preparation of small quantities of slab rubber has recently been observed in the Districts of Klang and Ulu Selangor.

The range of prices per picul, during the quarter, for this grade of rubber in the following centres was, Krian \$1.50 to \$6, Taiping \$5 to \$6, Kuala Langat \$2.50 to \$5, Klang \$3.25 to \$5, Ulu Selangor \$2 to \$7.

The following table shows the relative percentage of the sale of smoked, unsmoked sheet, "slab" and scrap, in Districts where records have been taken.

DISTRICT.	Percentage of smoked sheet.	Percentage of unsmoked sheet.	Percentage of 'slab'.	Percentage of scrap.
Kuala Langat	15	68	12	5
Klang	90	10	—	—
Kuala Selangor	100	—	—	—
Ulu Selangor	86	14	—	—
Kuala Lumpur	30	60	—	10
Ulu Langat	76	18	—	6
Malacca Central	—	79	—	21
Alor Gajah	—	85	—	15
Jasin	—	63	—	37

Tendency to Abandon Rubber Cultivation for Alternatives.

Reports have been received of the cutting out of very small areas of rubber in Selangor and Perak Central during this quarter, in order to make room for the cultivation of food crops. This has occurred chiefly in the immediate neighbourhood of large towns, in areas where all the available land is devoted to rubber. Increasing attention is being given to the cultivation of foodstuffs on land alienated for this purpose on temporary occupation licenses. Greater care is being given to land planted with coconuts and the formerly neglected mixed orchards containing coconut and various fruit trees which are frequently found in the neighbourhood of the dwelling houses especially in the more remote country districts.

There has been no report of newly planted areas during this quarter.

Planting Distances

Observations on the planting distances on small-holdings are now being taken in many districts: the minimum planting distance observed to date is 7 feet x 7 feet which is the average on 10 holdings in Banir in Perak South. The following table shows the average distances measured on eighty-three of the widely distributed holdings where bark consumption observations are being taken: these are listed under the ages of the trees on these holdings for the purposes of comparison.

Age of Trees.	Percentage of holdings of this age.	Average planting distances.
10 to 12 years	12	16 ft. x 17 ft.
13 to 15 "	23	14 ft. x 14 ft.
16 to 18 " and over	65	14 ft. x 15 ft.

The minimum distance observed on these holdings is 8 feet x 10 feet and the maximum distance is 18 feet x 30 feet.

H. D. M.

Reviews.

Plantation Sheet Rubber Manufacture.

Planting Manual No. 3 by R. O. Bishop, published by the Rubber Research Institute of Malaya, Kuala Lumpur, February, 1932, 61 pages, 48 illustrations and diagrams and 8 graphs, price \$2/-.

This publication coming as it does at a time of urgent need for economy, is particularly valuable: its object being to supply information not only on the preparation of improved sheet rubber but on its production at the lowest possible cost.

The Manual embraces the entire process of operations from latex collection to the grading and packing of the finished product. By the inclusion of numerous illustrations the text has been reduced to a minimum.

In the preliminary chapter on latex collection, selective tapping of higher yielding trees and the commencement of tapping operations at as early an hour as possible are advocated. An interesting chart taken from an actual estate record illustrates the reduction in tapping costs effected by selective tapping with a corresponding reduction in the number of labourers employed. The importance of collecting the utmost possible quantity of clean, fresh latex is urged and as the practice of selective tapping means an increase of the area of the tapping task with a consequent delay in the collection of the latex, the use of an anti-coagulant is advocated.

A chapter is devoted to the important problem of latex transport from tree to factory, in which the subject is treated exhaustively from an economic standpoint.

Just now, when the tendency is to abandon divisional factories and, wherever possible, to centralize the work of rubber preparation, the information contained in this chapter will be found very helpful.

Under the heading of latex handling, illustrations are given showing the relative size of sand and bark particles present in the latex and the holes in a 60 mesh sieve. The absolute necessity of reducing the viscosity of latex in order to facilitate straining and the settling of sand particles, is pointed out. Diagrams illustrating suitable types of sieves are shewn in the Manual. The author points out that theoretically there should be no need for sieving if the latex, after being diluted with the necessary amount of sodium sulphite added to the bulking water further to reduce its viscosity, is allowed to stand in settling tanks before it is run into the coagulating tanks.

The supremely important procedure of coagulation is dealt with in the Manual; the desirability of coagulating latex with the maximum dry rubber content, to produce a uniform sheet as large and as thin as possible, is borne in mind throughout this chapter. A table is given in which are shewn variations in the dry rubber content of latex collected at different times of the year after standardisation to a constant density; another table indicates the

variation between *true* dry rubber content and *recorded* dry rubber content by metrolac, in latex containing different quantities of stock solution of sodium sulphite. The handling of the coagulum is a very important factor in the efficient running of a sheeting plant, and yet it may be said to be a matter which, on many estates, has not received as much attention as it deserves. All too frequently the difficulties of handling a coagulum of the correct degree of plasticity for rolling into a perfect sheet are avoided by the practice of issuing an increased amount of coagulant; but, as the author says, "There is no reason why coagulum should be made tough and untearable to satisfy the inefficiency of factory procedure." The use of a water filled trough or chute running from the coagulating tanks to the sheeting battery is recommended for the conveyance of the coagulum; this not only minimizes the possibility of damage but requires the employment of only one operator. The undesirable practice of kneading or heavy preliminary hand-rolling, which is generally necessary when dealing with tough coagulum, together with transport by hand, or the piling of coagulum into trucks, are thus avoided.

Under the chapter headed "Machining" an interesting chart illustrates the reduction of factory labour consequent on centralizing factory work on an estate which previously handled its crop in three buildings. The cost of carrying out the necessary alterations was \$650 and the consequent saving of labour represents \$180 per mensem.

The factors which determine the cost of sheet manufacture are, of course, the output of rubber per hour and the number of coolies required to attend to the battery; in order to effect improvements in existing conditions the Manual points out that close attention must be paid to the factors controlling the characteristics of the coagulum and the speed with which it is fed to the machines.

In most factories there is a definite delay in the transference of coagulum from one roller to another; it is recorded that the piling up of sheet between the machine has resulted in an observed case in the battery's running idle for almost as long as it was running under load.

Many suggestions are given for comparatively simple re-arrangements of the factory outlay and methods of procedure designed to increase efficiency of machinery operations, particulars of actual examples explaining the bearing these considerations have on curing costs, together with a dozen illustrations of improved types of sheet rolling batteries; a model layout of up-to-date equipment and a diagram of an ideal sheeting plant.

The final washing of sheet after it has passed through the last machine is a procedure the importance of which is frequently overlooked: imperfect washing is one of the principal sources of defects in sheet rubber.

When it is remembered that the final bath through which sheet passes, frequently contains a large percentage of serum drained off from earlier sheets, the vital importance of thorough washing will be realised.

The desirability of adequate air-drying before sheets are placed in the smoke house, is insisted upon. It is well known that sheet with a high water

content when placed in a hot smoke house is liable to develop bubbles and blisters, but if the moisture has been reduced to approximately 5 per cent. beforehand it can be dried at a temperature up to 140°F. without danger: moreover, this preliminary drainage without the use of artificial heat results in fuel economy. It has been frequently offered as an argument against preliminary air-drying that this practise creates the fault known as "rust"; this, however, the author denies, while acknowledging that air-drying does accentuate any tendency for "rust" development, a tendency which would be absent if the sheet had been adequately washed beforehand.

A chart illustrates the considerable reduction in the moisture content of sheet when hung to dry at atmospheric temperature for one day before being placed in the smoke house.

The causes which delay drying and reduce the efficiency of smoke houses are discussed. It is pointed out that it is the distribution of heat and smoke that is fundamental so that the design of furnace is important.

Full particulars and diagrams of smoke house furnaces, charts showing fluctuations in temperature in smoke houses and calculations showing what space is actually needed to accommodate a particular weight of rubber, are all given in the Manual.

The chapter on lower grades is very informative; helpful advice is given on the sorting, treatment and machining of scrap.

In the notes on Grading and Packing, it is remarked that:—

"In many instances on estates the grading of the rubber is left entirely to one or two labourers working by themselves tucked away in a building where the light is poor and the results are obscure. So much depends on the efficiency of the sorters and so much risk attends a mistake on their part that it seems worth while to supply them with standards to guide their selection—and to display such standards in a conspicuous manner so that while the sorter is at work, he will be constantly faced with what he is supposed to select."

In conclusion the author remarks that:—

"The day has already arrived when the quotations for standard sheet and remilled blanket show insignificant margins, and it seems that even these are likely to disappear as the market approaches saturation unless we can modify and adopt *our* product to the requirements of the consumer. If he does not trouble to inform us of these, we should at least aim at offering rubber of strictly *uniform quality*."

This can only be attained by precise control of all our manufacturing operations and to achieve this, a proper understanding of plantation factory work is fundamental."

H. D. M.

**Ninth Report on Native Rubber Cultivation in the N.E.I.
Fourth Quarter, 1931.**

*The following is an abstract of the Report dated February 15, 1932,
prepared by the Bureau of Agricultural Economics of the Division
of Agriculture of the Netherlands Indian Department of
Agriculture, Industry and Commerce at Buitenzorg, Java.*

Owing to the abandonment of the gold standard by Great Britain, London and Singapore quotations are unsuitable for the purpose of studying the relation between price fluctuations and the exports of native rubber. The Java quotations, however, follow the fluctuations in price at New York.

The fall in prices continued throughout 1931. Exports of native rubber reacted rather sharply to the price fluctuations, a fact which was more evident during times of low prices. That the decrease in exports during the third quarter has been less than during the first two quarters of the year must be ascribed not only to fluctuations in price but to the fact that in the second half of the year the raising of foodstuffs demanded much labour.

The decline in rubber prices since 1928 has brought about a situation in which the native population which produces rubber has come to regard rubber as a source of additional income and not as the one and only source of income. This is particularly marked in Acheen, Tapanoei, Sumatra West Coast, Banka and Billiton. In districts where the only other source of additional income is jungle produce, rubber exports have been maintained to a better degree.

Table I of the Report shews the monthly exports of native rubber from the Outer Provinces in metric tons, from which the figures in the following table are drawn:—

**TABLE I.
Annual Export of Native Rubber (dry equivalent) from the
Outer Provinces in metric tons.**

Year	Sumatra Coast	East Acheen	Tapa- noeli	Sumatra West Coast	Riouw	Djambi	Palam- bang
1929	14,439	522	3,389	788	8,312	22,819	15,687
1930	11,026	473	2,676	490	6,864	19,870	10,630
1931	10,837	288	1,699	299	7,417 *	21,185	10,656

Year	Binkoe- len	Lam- pong	Banka	Billiton	West Borneo	South & East Borneo	Total
1929		56	714	113	20,315	21,429	108,583
1930	1	31	211	41	20,309	17,874	90,496
1931			42	11	19,288	16,265	87,987

* Indragiri.

The actual decrease in exports is not large compared with 1930, in spite of the fact that prices fell during the course of 1931 to about 50 per cent. of that ruling at the beginning of the year. However, taking into account that the potential production is still increasing, it must be concluded that there has been a decided decline in production of recent years compared with the estimated potential production. The following table from the Review illustrates this fact:—

TABLE II.
Potential and Actual Production of Native Rubber in N.E.I.

Year	Potential production (dry) Metric tons.	Actual production (export dry) Metric tons.	Actual production in % potential production per cent.	Average annual price for Java standard sheet at Batavia (Guilder cents) per $\frac{1}{2}$ K.G.
1927	100,000	100,491	100	99
1928	110,000	91,353	83	58 $\frac{1}{2}$
1929	120,000	108,584	90	54
1930	150,000	90,096	60	30 $\frac{3}{4}$
1931	200,000	89,736	45	15
1932	250,000			
1933	300,000			

From available statistics, a comparison is made of the manner in which groups of producers have reacted to the unfavourable conditions. All figures are given in metric tons:—

TABLE III.

	PRODUCTION (NET EXPORTS).					
	TOTAL			IN PERCENTAGE OF 1929		
	1929	1930	1931	1929	1930	1931
NETHERLANDS						
INDIA						
Estate ...	154,154	153,530	167,000	100	99.6	108.0
Native ...	108,584	90,496	89,736	100	83.3	82.6
BRITISH MALAYA						
Estate ...	249,409	236,775	243,267	100	95.0	97.5
Small-holdings	213,409	200,072	198,549	100	93.8	93.0
CEYLON	81,929	77,388	62,595	100	94.5	76.4
Rest Planted rubber ...	44,200	40,100	41,600	100	90.7	94.1

"Should we have made the foregoing comparison on the basis of potential production, then it would have become still more evident that in the Netherlands Indian native rubber cultivation the greatest possible natural restriction has been effected."

The following remarks are drawn from the summary of reports received from the more important producing provinces.

Acheen and Dependencies. (Fourth Quarter, 1931). Tapping rubber has almost entirely ceased, only about 5 per cent. of the productive area being exploited. The reason for cessation of tapping was mainly low prices, but it may be partly accounted for by the demand for labour for rice cultivation. Practically no rubber trees have been cut down as there are large reserves in sub-districts available for cultivation of food crops.

Tapanoeli. (Fourth Quarter, 1931). Larger export of rubber in this Quarter is due to realisation of stocks. Tapping is done only irregularly and usually only to meet a temporary demand for money. Extensive productive areas were left unexploited.

Sumatra West Coast. Tapping declined considerably mainly owing to low prices. The quality of rubber improved in the sub-district of Loeboek Sikaping where also greater activity in tapping was shewn during the third quarter owing to the need for cash. While extensive areas remain untapped, especially those situated off the beaten track, there is no reduction in the area planted with rubber.

Riouw and Dependencies (Second Quarter, 1931). Where the population has other sources of income, rubber cultivation is of secondary importance. Tapping has declined on the whole and is done mainly by family labour.

Palambang (Fourth Quarter, 1931). A decrease in exports is explained by the appreciable decrease in tapping, partly due to the planting of the *ladangs* which demanded much labour in November, and also due undoubtedly to the low prices.

Western Division of Borneo. (Fourth Quarter, 1931.) On the whole the production was fairly constant. Accumulation of stocks did not occur to any degree. The percentage of area of productive rubber which was not being worked was estimated as follows:—Singkawang 50, Pontianak district 40, Sintang district 50, Soengei Kakap district 25, Sambas district 25. In Mempawah and Sambas the plantations were extended slightly. No important areas were lost.

Southern and Eastern Division of Borneo. (Fourth Quarter, 1931). A decrease in exports and in production is caused by low prices, the work on the *sawahs* and *ladangs* and the abundance of rain in December. Tapping is mainly in the old gardens near the villages. The planted area has not extended, but neither have any large areas been lost by fire, diseases or other causes.

Another remilling factory has been closed, so that now only one factory is still in operation. This factory and the dealers in the interior react very strongly to small price increases cabled from Singapore.

D. H. G.

AREA OF LAND PLANTED WITH RUBBER IN MALAYA AT THE END OF 1931.

STATE OR TERRITORY	Estates of 100 acres and over			Estates under 100 acres Total acres	Total area planted acres
	Tappable acres	Immature acres	Total acres		
Perak ...	238,420	34,716	273,136	250,166	523,302
Selangor ...	294,030	47,437	341,467	154,854	496,321
Negri Sembilan ...	217,002	55,051	272,053	81,142	353,195
Pahang ...	35,122	23,470	58,592	75,562	134,154
Total F.M.S. ...	784,574	160,674	945,248	561,724	1,506,972
Malacca ...	110,288	9,839	120,127	74,860	194,987
Province Wellesley ...	44,055	6,833	50,888	19,826	70,714
Penang Island ...	1,585	236	1,821	11,212	13,033
Dindings ...	6,700	1,220	7,920	7,667	15,587
Singapore Island ...	28,033	2,628	30,661	12,781	43,442
Total S.S. ...	190,661	20,756	211,417	126,346	337,763
Johore ...	313,385	245,623	559,008	241,747	800,755
Kedah ...	—	—	193,359	102,124	295,483
Perlis ...	Not available		2,633	4,926	7,559
Kelantan ...	"	"	33,998	58,789	92,787
Trengganu ...	"	"	10,000	20,000	30,000
Total U.M.S. ...	—	—	798,998	427,586	1,226,584
Total Malaya ...	—	—	1,955,663	1,115,656	3,071,319

Figures for Kedah are those at end of 1930, the 1931 figures not being available at present.

Certain of the above figures are subject to slight alterations.

AREAS OF RUBBER TREES BUDGRAFTED IN MALAYA.

(By size of budgrafted areas)

STATE OR TERRITORY.	In areas of over 1,000 acres each.		In areas of between 100— 1,000 acres each.		In areas of between 10—100 acres each.		In areas of under 10 acres each.		Total Number of Budgrafted areas	Total Acreage of Budgrafted areas
	No. of areas	Total Acreage	No. of areas	Total Acreage	No. of areas	Total Acreage	No. of areas	Total Acreage		
F.M.S. :—										
Perak	—	—	33	7,663	41	1,766	20	95	94	9,524
Selangor	4	11,594	39	14,026	41	1,802	20	89	104	27,511
Negri Sembilan	5	11,609	39	12,065	24	1,010	7	31	75	24,715
Pahang	4	7,275	8	3,465	11	543	1	1	24	11,284
Total F.M.S.	13	30,478	119	37,219	117	5,121	48	216	297	73,034
S.S. :—										
P. Wellesley	—	—	1	262	5	205	6	30	12	497
Dindings	—	—	1	787	—	—	—	—	1	787
Malacca	—	—	11	2,944	9	244	6	23	26	3,211
Singapore Island	—	—	—	—	—	—	1	9	1	9
Total S.S.	—	—	13	3,993	14	449	13	62	40	4,504
U.M.S. :—										
Kedah	4	16,276	10	3,303	14	530	1	4	29	20,113
Johore	6	20,345	41	16,817	26	1,115	5	28	78	38,305
Kelantan	1	1,763	—	—	5	255	—	—	6	2,018
Total U.M.S.	11	38,384	51	20,120	45	1,900	6	32	113	60,436
Total Malaya	24	68,862	183	61,332	176	7,470	67	310	450	137,974

The above statement is compiled from returns submitted by estates and is believed to be approximately correct for the F.M.S. and S.S., Kedah and Kelantan. The Johore figures are compiled from 493 estates from a total of 583 Estates. Of the 90 estates which have not sent in returns, 56 are under old rubber and fully planted and the balance young rubber. Asiatic-owned and unlikely to include any considerable areas of budgrafted rubber.

AREAS OF RUBBER TREES BUDGRAFTED IN MALAYA.

(By years of budgrafting)

STATE OR Territory	YEAR OF BUDGRAFTING										Total area Budgrafted of 1931	Total area of bud- grafted Rubber in Tapping
	1922 or Earlier	1923	1924	1925	1926	1927	1928	1929	1930	1931		
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
F.M.S. :-												
Perak	1,208	286	99	—	96	203	796	1,099	2,683	3,054	9,524	1,029
Selangor	1,042	695	420	169	732	1,292	1,894	8,129	8,598	4,540	27,511	2,019
Negeri Sembilan	—	82	120	187	247	2,294	4,315	5,587	6,589	5,294	24,715	315
Pahang	—	—	—	—	—	5	319	3,814	3,283	3,863	11,284	—
Total F.M.S.	2,250	1,063	639	356	1,075	3,794	7,324	18,629	21,153	16,751	73,034	3,363
S.S. :-												
P. Wellesley	—	—	—	—	—	—	—	77	332	88	497	—
Dindings	194	—	—	85	101	250	95	—	—	62	787	128
Malacca	—	—	43	—	64	257	487	834	557	987	3,211	43
Singapore Island	—	—	—	—	—	—	—	—	9	—	9	—
Total S.S.	194	—	43	85	147	507	582	911	898	1,137	4,504	171
U.M.S. :-												
Kedah	3,332	1,815	6,351	2,441	73	301	1,596	823	1,624	1,757	20,113	10,459
Johore	110	1	10	38	714	2,571	2,017	11,065	8,939	12,840	38,305	89
Kelantan	—	—	—	—	—	—	—	32	261	1,725	2,018	—
Total U.M.S.	3,442	1,816	6,361	2,479	787	7,713	3,613	11,920	10,824	16,322	60,436	10,548
Total Malaya	5,886	2,879	7,043	2,920	2,009	2,872	11,519	31,460	32,875	34,210	137,974	14,082

**NATIONALITY OF OWNERSHIP OF PLANTED RUBBER ESTATES
OF 100 ACRES AND OVER, 1931.**

Straits Settlements and Federated Malay States.

TERRITORY	NON-ASIATIC		CHINESE		JAPANESE		INDIAN		MALAY		TOTAL	
	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres	No.	Acres
FEDERATED MALAY STATES—												
Perak ...	222	236,869	79	22,071	—	—	51	11,681	15	2,515	367	273,136
Selangor ...	230	303,880	92	28,035	4	2,043	30	6,756	2	753	358	341,467
Negri Sembilan ...	167	234,377	82	23,597	8	5,667	31	6,797	6	1,615	294	272,053
Pahang ...	34	38,213	46	18,686	—	—	7	1,693	—	—	87	58,592
Total F.M.S. ...	653	813,339	299	92,389	12	7,710	119	26,927	23	4,883	1,106	945,248
STRAITS SETTLEMENTS—												
Province Wellesley ...	21	43,398	27	7,371	—	—	1	119	—	—	49	50,888
Dindings ...	7	5,653	8	1,712	—	—	1	232	2	323	18	7,920
Malacca ...	46	81,041	73	30,006	—	—	27	8,026	5	1,054	151	120,127
Penang ...	1	492	5	910	—	—	3	419	—	—	9	1,821
Singapore ...	12	16,225	49	12,865	—	—	2	1,114	2*	457	65	30,661
Total S.S. ...	87	146,809	162	52,864	—	—	34	9,910	9	1,834	292	211,417

* Including one estate owned by Arabs.

TAPPABLE RUBBER OUT OF TAPPING, MALAYA, 1931.

(Estates of 100 acres and over)

Month	FEDERATED MALAY STATES						STRAITS SETTLEMENTS						UNFEDERATED MALAY STATES					Total Malaya
	Petrik	Selangor	Negri Sembilan	Pahang	Total F M S	Province Wellesley	Dindings	Malacca	Penang	Singapore	Total S S	Johore	Kedah (a)	Kelantan	Trengganu (b)	Perlis	Total U M S	
January	23806	36218	28495	10321	100826	9171	1809	17353	798	8993	38124				Statistics not compiled			
February	27496	39958	36965	6429	110848	8498	1873	23508	1277	14156	49312			"	"			
March	34892	44285	36480	11186	126843	9780	1548	25021	1280	14027	51656			"	"			
April	36068	49395	35408	10557	131428	11299	1845	21084	1140	14475	49843			"	"			
May	32485	45592	39582	11227	128886	14382	1677	25790	807	14864	57520			"	"			
June	34619	47599	41752	11389	135359	10166	1569	25404	920	14627	52686	74376	13354		Statistics not Compiled			
July	36158	50005	36937	11273	134373	10636	1713	25512	917	15609	54887	73047	13354		"	"		
August	36442	54813	38479	11181	140915	10779	1931	23199	912	14893	51714	72609	13354		"	"		
September	37015	53754	38602	11323	140694	10886	1938	22695	897	15319	51735	72775	29743		"	"		
October	36770	53324	40824	12172	143090	11069	1896	22764	884	15731	52344	69077	29743		"	"		
November	35757	50690	37559	11381	135387	10905	1876	22088	862	15810	51541	68502	29743	7699	ml	464	106408	263336
December	35382	49238	35861	11105	131586	11530	1875	21024	862	15982	51273	65535	26881	10899	ml	464	103779	286638

(a) Registered Companies only and are rendered quarterly

(b) Registered Companies only

PRODUCTION OF RUBBER, MALAYA, 1931.

MONTH	Straits Settlements			Federated Malay States			Unfederated Malay States		Total Malaya	
	Estates	Small holdings		Estates	Small holdings		Estate	Small holdings	Estates	Small holdings
January	2,032	2,000		12,268	10,029		6,492	6,100	20,792	18,129
February	1,809	2,000		11,383	9,282		5,587	5,576	18,779	16,858
March	1,810	2,000		11,447	10,235		5,656	6,121	18,913	18,356
April	1,723	1,738		9,927	5,754		5,389	4,433	17,039	11,925
May	1,928	2,420		11,142	7,982		5,834	4,997	18,904	15,399
June	1,985	2,625		11,316	8,727		5,713	5,320	19,014	16,673
July	2,220	2,128		12,723	8,056		6,428	5,507	21,371	15,691
August	2,213	2,384		12,588	7,693		6,140	4,829	20,941	15,106
September	2,137	2,416		11,995	9,687		6,108	4,490	20,240	16,593
October	2,266	2,168		12,493	8,473		6,432	5,642	21,191	16,283
November	2,273	2,414		11,848	10,263		6,984	4,830	21,105	17,507
December	2,370	2,448		12,327	9,197		6,552	6,943	21,249	18,588
Total	24,766	26,942		141,457	105,378		73,315	64,788	239,538	197,108

Compiled from monthly records published by the Department of Statistics, S S & F M S

PRODUCTION RATE ON RUBBER ESTATES—F.M.S. & S.S.

YEAR 1931.

MONTH	FEDERATED MALAY STATES			STRAITS SETTLEMENTS		
	Estates		Small Holdings	Estates		Small Holdings
	Production on total tappable rubber	Production on area actually tapped	Production on probable tappable area*	Production on total tappable area	Production on area actually tapped	Production on probable tappable area*
	lbs per acre per annum	lbs per acre per annum	lbs per acre per annum	lbs per acre per annum	lbs per acre per annum	lbs per acre per annum
January . .	421	483	518	280	351	431
February .	422	480	512	267	359	433
March ..	393	471	529	251	344	431
April ...	353	426	307	246	330	384
May ...	383	460	412	267	362	522
June . .	401	488	461	283	392	584
July ...	437	530	418	307	418	458
August ...	432	530	397	306	420	557
September	428	522	507	315	416	537
October ...	430	527	438	313	432	467
November ...	420	511	547	324	445	537
December ...	318	381	616	328	448	527
Average yield per acre per annum	403	484	472	291	393	489

* Planted area at the end of 1926

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF FEBRUARY, 1932

AREA	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Federated Malay States	784,574	33,678	4.3	96,660	12.3	130,338	16.6
Johore	313,385	21,309	6.8	46,511	14.8	67,910	21.6
Kedah (a)	(b) 118,236	11,175	9.4	15,706	13.3	26,881	22.7
Kelantan	16,785	6,742	40.2	796	4.7	7,538	44.9
Trengganu (c)	4,300	nil	nil	nil	nil	nil	nil
Perlis	624	308	49.4	156	25.0	464	74.4
Straits Settlements	190,661	18,520	9.7	34,797	18.3	53,317	28.0
MALAYA	1,428,565	91,822	6.4	194,626	13.6	286,448	20.0

Notes:—1. (a) Registered companies only and are rendered quarterly, commencing with end June 1931,
(b) Estimated in the ratio of acreage of tappable rubber to acreage planted end 1930.

(c) Registered companies only

2. Areas rested due to rotational tapping system end February: acres F.M.S. 44,428, Johore 35,248, Kedah 34,713, Kelantan 1,005, Trengganu 1,394, S.S. 15,284, total 132,072 acres or 9.2 per cent. of tappable area (Col. 2).

SINGAPORE, April 11, 1932.

J. I. MILLER, M.C.S.
Ag. Registrar-General of Statistics,
S.S. and F.M.S.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVEITED.
FOR THE MONTH OF MARCH, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1		Production by Estates of less than 100 acres estimated ²		Imports		Exports including re-exports		Stocks at end of month	
	Dealers	Ports	during the year 1932	during the month	From Foreign	From Malay States	Foreign	Local	Ports	Dealers
MALAY STATES:—										
Federated Malay States	19,408	13,063	10,822	6,154	Nil	Nil	19,697	4,847	...	19,438
Jobore	2,410	3,462	3,531	2,983	Nil	3	969	5,497	...	2,437
Kedah	431	2,273	1,969	6,774	Nil	Nil	14	635	...	439
Perlis	189	124	156	389	Nil	Nil	Nil	910	...	2,802
Kelantan	35	30	77	284	Nil	Nil	Nil	6	...	33
Trengganu	...	...	...	...	Nil	Nil	Nil	314	...	112
Total Malay States	22,532	18,988	16,563	54,598	73	14	14,270	12,829	...	22,498
SETTLEMENTS										
Malacca	4,945	1,227	1,263	4,132	Nil	Nil	3,666	...	...	4,565
Province Wellesley	86	598	395	1,321	Nil	Nil	11,756	...	...	78
Dindings	187	116	85	302	12,834	Nil	4,667	...	...	275
Penang	1,595	5,609	10	11	2,071	17,749	17,810	...	...	1,150
Singapore	3,594	40,668	224	496	463	5,016	25,633	...	...	2,968
Total Settlements	5,189	61,495	2,175	1,891	5,471	19,820	47,225	...	...	3,515
TOTAL MALAYA	5,189	74,027	21,163	18,462	60,671	11,424	44,400	5,621	12,837	19,893

TABLE II
DEALERS' STOCKS, IN DRY TONS.

Class of Rubber	Fede- Malay States		Prov- S'pore		Total	
	21	22	23	24	25	26
DRY RUBBER	16,614	35,393	4,278	4,706	900	61,861
WET RUBBER	2,818	2,676	822	212	1,597	7,565
TOTAL	19,432	38,039	4,600	4,918	2,437	69,426

TABLE III
FOREIGN EXPORTS

Ports	For month 1932	
	27	28
Singapore	26,057	74,825
Penang	8,804	29,591
Port Swettenham	4,613	16,564
Malacca	429	3,569
MALAYA	39,903	124,541

TABLE IV
DOMESTIC EXPORTS

Area	For month 1932	
	27	28
Malay States	...	34,076
Straits Settlements	...	10,063
MALAYA	...	44,076

- Notes:—**
1. Stocks on estates of less than 100 acres and stocks in transit on rail road or local steamer are not ascertained.
 2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. \therefore Column [7] = Columns [1] + [14] + [17] + [18] + [19] + [19A] - [2] - [3] - [4] - [5] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of rubber for the month of March, 1932, reduced by 15% to terms of dry rubber. The Kelantan figures in columns 5 and 19 have not been received and those for February are repeated.
 3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 26%; scrap, lump, 40%; stock elsewhere are in dry weights as reported by the dealers themselves.
 4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month. The foreign exports of the later month are estimated from the monthly domestic production of rubber.
 5. The main communication, is the Report published by W. R. Boyd, M. C. Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd April, 1932.

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather varied considerably in different parts of the country during the month. In Kedah the short wet season commenced in the middle of the month, while wet weather with frequent thunderstorms, often accompanied by high winds, was experienced in Penang and Province Wellesley, the inland districts of Perak and Selangor and the east coast of Pahang. In western Pahang, Negri Sembilan and Johore the weather was hot with showers or thunderstorms at intervals. On the west coast from Krian southward to Singapore Island conditions were fairly hot and dry, except in Selangor where the second half of the month was wet and stormy.

Remarks on Crops.

Rubber.—Prices for small-holders' rubber ranged in dollars per picul from 4 to 7 for smoked sheet, 3 to 6 for unsmoked sheet, 1 to 4 for scrap and 1 to 3.75 for lump. Exceptionally high prices of \$10.25 for smoked and \$8.50 for unsmoked sheet were recorded at Sungei Patani in Kedah. In Penang the market was becoming selective, better prices being given for good quality sheet. In Selangor lump rubber was difficult to sell, as it had been found to be heavily adulterated.

The area untapped is increasing steadily owing mainly to the low price, but in parts also to the commencement of work on padi land. Where tapping is continued it is frequently excessive in an attempt to obtain enough rubber to purchase necessities, especially where owners are entirely dependent on their rubber. In Selangor it was noticed that tapping was being done by children or old men and women, while the more able bodied members of the family employ their time in planting other crops or doing other work.

In Penang rubber interplanted with cloves or fruit trees is being cut out by some owners while in one or two localities in Selangor owners have also cut out some of their rubber to plant fruit and vegetables.

Leaf mildew (*Oidium Heveae*) was reported from Perak South, Selangor, Negri Sembilan, Malacca and parts of Johore, but none of the attacks was serious, except in parts of Johore in which State the disease has now been made notifiable by law.

Mouldy Rot disease became more prevalent in Kedah during the wetter weather and its control was increasingly difficult to enforce. Elsewhere it was not more in evidence than usual and in some localities it decreased owing to cessation of tapping.

Padi.—The padi harvest was practically completed everywhere at the end of the month, and yields were on the whole satisfactory, except in areas along the Pahang and Perak rivers damaged by the floods in December, 1931.

In parts of Selangor the inter-season crop was planted, while elsewhere preparation of the land was commenced before the time arranged owing to the desire for additional supplies of padi as early as possible. In Pahang an unexpected flood in March destroyed many nurseries along the Pahang river. These were resown where seed was available, but in the Pekan District a further seed supply of a short duration variety has had to be procured through this Department. Elsewhere in Pahang, in Negri Sembilan and Johore work on the new crop in different stages of advancement was in progress.

It is noteworthy that in Province Wellesley a few enterprising Malays owning well-drained land have planted about half an acre each of fallow padi land with vegetables, while near Lenggong in Perak maize has been planted after the padi crop. Where planting operations are in progress efforts are being made to utilise all available padi land.

In Malacca arrangements were made for the organised distribution of selected padi seed.

Padi prices have fallen slightly, ranging between 6 and 8 cents in the larger padi areas and between 6 and 12 cents elsewhere.

Pineapples.—Canning factories in Singapore were working overtime to cope with the large quantities of fruit received. In Johore also all the factories were working at full output. Prices both for fresh and canned fruit were considerably higher than during the corresponding period of last year. Prices for Good Average Quality canned pineapples varied from \$3.58 to \$4/- per case and a premium of 60 cents was paid by London buyers for Golden quality.

Tobacco.—While the cultivation of this crop is declining in Penang and Province Wellesley, interest in it is well maintained in many other parts of the country. Prices are, however, falling owing to the inferior quality of much of the cured leaf produced. The wide range of prices from \$10/- to \$80/- per picul according to locality and quality is an indication of the need for better methods of preparation and of the advisability of studying, before planting is commenced, the kinds of tobacco for which there is a local demand, so that the correct type can be planted and the method of curing be adopted to meet local requirements.

Tea.—There has been a very considerable improvement in the yields as well as in the growth of the tea bushes on the Chinese small holdings at Sungei Balak in Selangor as a result of following the advice given by this Department. The Chinese headman claims that his yield has doubled and that he is now making a good profit although the price has fallen to 30—35 cents per kati for first quality tea.

Fruit.—In Johore the mango crop in Muar District was harvested and exported to Singapore. Early durians appeared on the markets in Selangor and Negri Sembilan together with small supplies of rambutans, mangosteens and

langsats in the latter State. In most localities the fruit crop has just set and promises well, but in Penang rain caused a heavy loss of very young fruits.

Malays everywhere are paying more attention to their fruit orchards and are planting bananas and pineapples on spare pieces of land.

Rat Control in Padi Fields.

During organised rat hunts for the purpose of digging nests of young rats out of the bunds of padi fields at Glugor in Penang island 6,000 rats were destroyed in three and a half days. In Province Wellesley this method of destruction continues to be neglected by padi planters even in their own interests. The distribution of poisoned baits has, however, been continued and over 1,000 dead rats have been found. In Krian trapping and poisoning in known breeding grounds and harbourages have been maintained with good results. In Malacca 96,928 tails were collected, many of the rats being dug out of nests in the padi fields.

Agricultural Stations and Padi Test Plots.

KEDAH—*Gajah Mati Agricultural Station*.—The drainage system and necessary paths were completed as well as two nursery sheds. The growth of the cover crops improved after the rains. Preparations were made for planting tuba, soya bean and cotton.

PENANG AND PROVINCE WELLESLEY —*Glugor Padi Test Station*.—A full report on the working of the Station during the 1931—32 season was completed and forwarded to headquarters for statistical examination. Nurseries for the inter-season crop made good growth in spite of heavy rains and floods. The plots for this crop were cleared in readiness for planting.

Bukit Merah Padi Test Station.—Ploughing was commenced early in the month and though hampered by heavy rains and floods was nearly completed at its close. Preparations were made for a small trial to demonstrate the possibilities of growing short-season vegetables and food crops during the period of 3 or 4 months when the land is normally allowed to lie fallow.

PERAK.—*Kuala Kangsar Agricultural Station*.—Crops planted were six stumps of each of four selected clones of budded rubber and fourteen varieties of yams. A good crop of an Australian strain of maize was reaped and a Rangoon variety of tobacco was harvested and yielded some very good leaves. Two varieties of tobacco, Chinese and Rangoon, were in process of curing, a procedure which was rendered difficult by wet weather. Giant snails, which found shelter in cover crop of *Calopogonium mucunoides*, proved troublesome and damaged young egg-plants. These pests were collected nightly.

Bruas Padi Test Plot.—The yields of the different plots have not yet been fully calculated, but the average yield is expected to be about 300 gantangs per acre as compared with yields of 50 to 100 gantangs per acre obtained from this land in past years by local cultivators.

SELANGOR.—*Cheras Agricultural Station.*—Crops planted were two varieties of siah, soya bean, rambutans, oranges, two selected pomelo marcots from China, gambier, cloves and a few stumps of four selected clones of budded rubber. Oil palms for shade purposes were planted on either side of the access road and the yellow-flowered *Peltophorum ferrugineum* along the road frontage for ornamental purposes. The Chinese market gardener planted up with vegetables the area allotted to him. The work of levelling off the sides of the fish pond and planting them with carpet grass was completed..

Kajang Padi Test Plot.—The clearing of the land was completed and the layout of plots improved. Transplanting from the nurseries was commenced at the end of the month.

Kuang Padi Test Plot.—Transplanting was commenced with Nachin 27 early in the month and was in progress with other strains at its close. Tuba solution successfully checked the attack of stem borer on the nursery seedlings of N. 27, but a few days after transplanting a number of Schoenobius moths and egg masses were found on the young plants in the fields, the moths having apparently emerged from "volunteer" padi. Egg masses were collected daily in the hope of preventing permanent damage.

NEGERI SEMBILAN.—*Rembau Agricultural Station.*—Seeds of cloves and nutmegs obtained from Penang were sown in nursery beds. To meet the demand for Sweet Corn seed an extra half acre was sown. A few budded rubber stumps of four selected clones were planted. Paths were planted with carpet grass and the drains received attention.

PAHANG.—*Kuala Lipis Agricultural Station.*—The flood at the end of March destroyed the tobacco, while ten arecanut palms died owing to the effects of the previous flood.

Temerloh Agricultural Station.—Drainage received attention. The covers and green manures made good growth. Liberian coffee seed was sown in the nursery.

Kuantan Agricultural Station.—Local tapioca, yams, sweet potatoes, maize and cowpeas were planted.

Pekan Agricultural Station.—Plots were replanted with tapioca, yams, maize and cowpeas. Several varieties of bananas were also planted. There was a good crop of oranges and limes.

Padi Test Stations.—Preparation of the Dong Station for the coming season's crop was commenced. At the Pekan Station two strains of padi were sown and the new land was cleaned.

MALACCA.—*Sungei Udang Agricultural Station.*—Crops planted included sweet potatoes, tapioca, sugar cane, ginger, arrowroot, sorghum, thirty varieties of vegetables, and six cinnamon seedlings. Pepper cuttings were planted out. Considerable progress was made with the levelling and bunding of the padi area.

SINGAPORE.—*Pineapple Experiment Station.*—The growth and appearance of the pineapples on the manurial plots has improved recently. The planting of green manurial crops on the plots reserved for green dressing and rotation

experiments was completed. The growth of the Hickory Prior variety of Virginian tobacco has been disappointing and the indications are that this variety is not so well suited to local conditions as the Joyner variety. It is satisfactory to note that the work at this station on tobacco and fruit trees, as well as on pineapples, is beginning to attract the attention of local agriculturists, more especially Chinese, whether owners of larger or of smaller properties.

School Gardens.

All school gardens have now been recultivated and replanted, but in some parts of the country the recently prepared beds have been severely washed and the young growing vegetables killed by heavy rains, necessitating reforming the beds and replanting. A number of gardens, however, showed good progress.

In Johore the new school gardens have been supplied with tools and lime where needed. Good progress has been made with the layout of the gardens and preparation of the beds which at most schools are nearly ready for planting.

EIGHTH MALAYAN EXHIBITION.

The Malayan Agri-Horticultural Association has decided to hold its annual Exhibition at Kuala Lumpur during the August Bank Holidays.

It is expected that the general scheme of the Exhibition will follow the lines of the Exhibition held last year. The various sections make provision for exhibits of all kinds of agricultural products of Malaya. Special attention will be given to foodstuffs and to the economic aspects of agricultural enterprise.

The fact that Malaya is experiencing a very grave economic depression should render this event of more than ordinary interest, for the attention of producers must be directed to the consideration of means of reducing costs of production and improving quality. The Exhibition will serve a very useful purpose if it assists in any way the achievement of these objects.

The organisers confidently look to all those engaged in agriculture for their support in sending exhibits. Full particulars will be published in due course, but those who wish for early information are invited to address their enquiries to the Secretary, Malayan Agri-Horticultural Association, 12 Barrack Road, Kuala Lumpur.

DEPARTMENTAL NOTES.

Tours of the Director of Agriculture.

The Director of Agriculture visited Fraser's Hill on February 27th and 28th and again on April 2nd and 3rd for the purpose of inspecting the work at the Dairy Farm. He made a tour to Negri Sembilan and Malacca between March 18th and 22nd, inspecting the principal departmental undertakings, visiting a number of estates and conferring with the Resident and Resident Councillor. He visited Cameron Highlands on April 8th to 11th, inspecting the work of the Agricultural Experiment Station and also visiting certain settlers in this region.

Investigations in the Chemical Division.

The monthly reports of the Chemical Division record a wide range of activities and shew also the extensive use which various agricultural industries in Malaya make of the facilities for investigation and advice offered by this branch of the Department of Agriculture.

During the month of March, 25 samples submitted by unofficals were examined. Twenty of these samples were sent from oil palm estates for analysis and report, two were concerned with jelutong and three with manures. The reports connected with samples sent from oil palm estates enable the producers to effect improvements in the technique of the production of palm oil and kernels, resulting in economy of production and improvement in quality.

Advisory work necessitated 17 visits, 14 of which were to the Government Experimental Plantation, Serdang. Furthermore, advisory work, not necessitating analyses or visits, numbered 6 and dealt with a wide range of subjects.

The research work of the Division is concerned with a number of crops and in one month necessitated 54 analyses.

The Chemical Division has a series of experimental work on the production of palm oil and kernels which is carried out in the experimental factory at Serdang. The manufacture of palm kernels was commenced during March. A small Culley net-cracker is being used and the kernels are separated by means of a clay bath.

A series of experiments have been carried out to determine the amount of palm oil that could be recovered by centrifuging a second time, after breaking up the residue and spinning for a further period of 10 minutes and injecting more steam. The results shewed that only a very small amount of oil was recovered, the oil content of the pericarp residue, calculated on a moisture-free basis, being reduced on the average from 24 to 23 per cent.

Other experimental work may be summarised as follows—

Coconuts.—An investigation regarding the composition of material from the point of view of plant nutrients removed from palms in the course of estate practice has been completed. The results are being summarised for publication.

Tuba Root.—Investigations regarding the rotonone content of tuba root from different local sources has been continued.

Padi.—An investigation has been commenced on the variation in the moisture content of padi as purchased at the Government Rice Mill, Bagan Serai.

An investigation on the chemical control of weed growth in padi irrigation water is in progress.

Fodders.—Investigations are continued on the natural variations in composition of fodder grass growing on the same plot.

Forest products.—An investigation on the relationship existing between the durability of certain timbers and the amount of alkali soluble material has been commenced.

Dairy, Poultry and Gardens at Fraser's Hill.

Mr. H. Ritchings, Horticultural Assistant, was in charge of the work at this station until he proceeded on leave on 3rd March, when Mr. C. M. Maggs was detailed to take over the work. Unfortunately the latter officer has been admitted to hospital, in consequence of which Mr. F. S. Banfield, Horticultural Assistant, was transferred to Fraser's Hill on 7th March to take his place.

The number of cattle at the Dairy Farm has been reduced by the sale of several old cows unfit for the dairy herd. A number of pure-bred Friesian bull calves have also been sold for breeding purposes.

In spite of such reductions the quantity of milk has increased and is ample to meet the present demand at Fraser's Hill. Arrangements have now been completed for the transport of fresh milk to Kuala Kubu.

Fat tests are regularly made of the milk. The average fat content of the milk is over 4 per cent., which is extremely satisfactory.

Egg production has been maintained and there has been no difficulty in the sale of produce at remunerative prices.

The very rainy weather has interfered somewhat with the quality of vegetables, but the supply for sale at Fraser's Hill has been fully maintained.

Leave.

Mr. H. T. Pagden, Assistant Entomologist, has been granted 8 months and 7 days leave on full pay, with effect from 12th February 1932.

Statistical. MARKET PRICES.

April, 1932.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 5.4 cents per lb. in Singapore, 1.46 cents (Gold) New York and 2.97d. per lb. London, as compared with 6.39 cents Singapore, 3.3 cents New York and 2.16d. London in March. The highest Singapore price in April was 5 7/16 cents and the lowest 5 1/16 cents per lb.

Palm Oil.—Cabled weekly quotations per ton during April, c.i.f. Liverpool on a basis of 18 per cent. f.f.a. were as follows:—1st, £19; 7th, £17; 14th, £16; 12st, £16; 28th, £16.10.0. Prices declined on the firming up of sterling. The market has been idle, but closed steady.

Regular quotations for palm kernels have not been received, the last price noted being £10.15.0 per ton on 7th April.

Copra.—Prices have remained steady during the month. Sundried averaged \$5.67 per picul as compared with \$6.17 in March, while the average price for Mixed was \$5.06 per picul as compared with \$5.67 in the previous month.

Copra cake was quoted at \$2.00 per picul throughout the month.

Gambier.—Prices have further declined during April, the average Singapore price for Cube No. 1 being \$17.50 per picul and for Block \$8.37 as compared with \$18.90 and \$11.80 respectively in March.

Rice.—The following are the average wholesale prices of rice per picul in Singapore in March:—Siam No. 2 Ordinary, \$4.26; Rangoon No. 1, \$4.12; Saigon No. 1, \$4.24 as compared with \$4.62, \$4.17, \$4.37 respectively in February.

Retail market prices in cents per gantang of No. 2 Siam rice in March were:—Singapore 32, Penang 38, Malacca 30. Corresponding prices in February were 32, 38 and 26.

Areanuts.—Prices show a tendency still further to decline. Average Singapore prices in April were:—Palambangs \$3.24, Bila \$3.32 per picul as compared with \$3.62 and \$3.59 respectively in March. For other grades the average prices per picul were as follows:—Split \$4.06 to \$5.58, Red \$6.55 to \$7.61, Sliced \$10.70 to \$12.85, Kelantan Split \$5.06 to \$5.49, the price within each range depending upon quality.

Coffee.—The Singapore market has been quiet and prices show a slight decline during the month. Average price of Sourabaya coffee was from \$19.95 to \$21.25 per picul, the price within these limits depending upon quality. The average price of Palambang coffee was \$15.65 per picul as compared with \$16.83 in March.

Pineapples.—The market has been somewhat lifeless. Increased Canadian duties are stated to have brought business with that country to a standstill, resulting in larger supplies being available for shipment to the United Kingdom.

Buyers are generally well below packers' prices. Average prices in April were 1½ lb. cubes \$3.47½ per case, 1½ lb. sliced flat \$3.30 per case, 1½ lb. sliced tall \$3.52½ per case as compared with \$3.63, ~~\$3.41~~ and \$3.73 per case in March.

Tapioca.—Prices of all grades shew a further fall over those quoted in March. Singapore average prices per picul in April were:—Flake fair \$2.81, Pearl, seed \$3.85, Pearl, medium \$4.21 as compared with \$3.12, \$4.48, \$4.70 in March.

Sago.—Prices showed a slight upward tendency towards the end of the month. Average prices for April were:—Pearl, small, fair \$4.17½ per picul as compared with \$4.45 for the previous month; Flour, Sarawak fair \$2.17½ as compared with \$2.38 in March.

Nutmegs and Mace.—Prices have been more or less nominal throughout the month with but little business. Average prices per picul for mace were as follows:—Siouw \$68.75, Amboina \$45 as compared with \$59.40 and \$44 in March.

Singapore average prices for nutmegs in April were, 110 per lb. \$25.37½ per picul, 80 per lb. \$28.87½ as compared with \$26.90 and 30.70 per picul in March.

Pepper.—Demand has been small and prices have shown little variation. The following are the average Singapore prices per picul for April:—Singapore black \$20.25, Singapore white \$24.25, Muntok white \$24.75. Corresponding prices in March were \$22.30, \$27.90 and \$28.35.

Cloves.—Nominal prices have been quoted throughout the month in Singapore at \$47 per picul for Zanzibar, and \$50 for Amboina.

The above prices are based on London and Singapore daily quotations for rubber, on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs.

The dollar is fixed at two shillings and four pence.

GENERAL RICE SUMMARY.*

March, 1932.

Malaya.—Gross foreign imports of rice during March amounted to 47,189 tons as compared with 60,481 tons in March 1931, of which 49.2 per cent. were consigned to Singapore, 25.2 per cent. to Penang, 5.3 per cent. to Malacca, 17.8 per cent. to the F.M.S. and 2.5 per cent. to the Unfederated Malay States.

Of these imports 44.3 per cent. were from Siam, 53.2 from Burma, 1.5 per cent. from French Indo-China and 1 per cent. from other countries.

The total foreign exports of rice in March were 13,668 tons as compared with 13,474 tons in March 1931. Of these exports, 81 per cent. went to Netherlands India.

India.—Total foreign exports of milled rice (*Indian Trade Journal* 31.3.32) during January 1932 were 168,000 tons as compared with 151,000 tons in December 1931.

Total exports of rice and rice products from Burma for the period January 1 to February 27, 1932, amounted to 600,549 tons as compared with 496,893 tons for the corresponding period of 1931, or an increase of 20.9 per cent.

Japan.—It is reported that the Government of Japan had decided to import 140,250 tons of foreign rice through nine large rice merchants and that this year's (1931—32) rice deficit is nearly 700,000 tons.

Siam.—According to the Third and Final Forecast of the 1931 Rice Crop (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the latest returns giving the conditions of the crop at the end of January 1932 show an increased yield and the exportable surplus of the Seven Inner Circles is estimated at 1,040,000 tons (rice) as compared with 1,000,000 tons (rice) mentioned in the Second Forecast. The Northern and North-Eastern Circles, which were estimated to be able to provide only for their own needs, is now estimated to have a surplus of 60,000 tons (rice) for export. The exportable surplus for the whole Kingdom is therefore estimated at 1,100,000 tons of rice.

Exports of rice from Bangkok during February 1932 amounted to 122,091 tons as compared with 97,612 tons in February 1931, an increase of 15.1 per cent.

Exports of rice from Bangkok during the period December 1931 to February 1932 amounted to 347,620 tons, an increase of 62,337 tons or 22 per cent. as compared with the same period of 1930—31.

The average value of the exports during February 1932 was \$(S)48.64 per ton as compared with \$(S)67.98 in February 1931, a decrease of 28.4 per cent. (104 ticals = \$100 (Straits)).

* The following is abridged from the Rice Summary for March 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Netherlands India.—The *Korte Berichten* states that at the end of February 1932, the area harvested amounted to 451,500 acres, an increase of 66,500 acres or 17.3 per cent. as compared with the same period of 1931, the area damaged to 17,162 acres an increase of 5,850 acres or 51.7 per cent. as compared with 1931, and additional plantings awaiting harvest to 6,956,250 acres an increase of 49,000 acres or .7 per cent. as compared with 1931, a total of 7,424,812 acres as compared with 7,303,560 acres for the same period of 1931, an increase of 1.7 per cent.

Imports of rice into Java and Madura during January and February, 1932 totalled 48,945 tons as compared with 61,731 tons for the same period of 1931 or a fall of 20.7 per cent.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 31.3.32 amounted to 331,038 (metric) tons, an increase of 72,087 tons or 27.7 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 31.3.32 amounted to 318,813 (metric) tons an increase of 96,110 tons or 43.1 per cent. as compared with 1931.

The following is an extract from the International Crop Report, Rome, for February, 1932:—"The rains of September were on the whole very beneficial, despite some destructive flooding; they allowed late transplantings to be carried out in some districts. Additional information indicates an extension of cultivated area in Tonkin; in Cambodia it does not seem that there has been any considerable reduction in area. The very heavy decrease in Annam and Cochin-China will, however, result in a reduction for Indo-China as a whole of about 1 million acres on that of last year so that the cultivated area has fallen back to the average level of the five years ending 1929—30.

The few partial data available and the general information regarding the crops harvested or the condition of those still standing makes it possible to say that the 1931—32 crop will be little below that of the previous season, despite the decrease in area; owing to the unfavourable conditions in Annam and despite the satisfactory results obtained in Tonkin, the unit-yield for Indo-China as a whole seems to be a little below the average but above that of last season and at least equal to that of 1929—30.

The few data available concerning stocks indicate that they are exceptionally high; according to official information there remained in Cochin-China on 15 September 1931 that is, six months after the harvest, though the commercial year is generally at an end for that Colony, about 440 million pounds of rough rice available for export, of which almost all must be spread over the 1932—33 season. In Tonkin and in Annam movement of the crop is difficult owing to the very strict limitation of exports and stocks are equally abundant and maintain the price at a level insufficient to cover cost of production."

The padi market (official report) in March 1932 was quiet with a tendency to weaken, owing to the amount of rice sold being less than the amount of padi received from the interior; the stocks held at Cholon were considerable.

The prices in the rice market rose in sympathy with the Rangoon market in the expectation of big orders to be placed by Japan.

As Japan did nothing and the other markets evinced no interest in Saigon, prices dropped rapidly. France bought moderate quantities and Hong Kong remained the chief buyer. The market as a whole was quiet with a tendency to fall but any important enquiries would probably cause a quick upward reaction.

The Brokens market was calm but steady. India made considerable purchases but finally only France was in the market for small packets

Europe and America.—Quantities of rice shipped from the East were :—

- (a) To Europe, January 1 to March 23, 1932, 186,090 tons as compared with 111,308 tons for the same period of 1931, or an increase of 67.2 per cent.
- (b) To the Levant, period January 1 to February 22, 1932, 9,711 tons, an increase of 6,509 tons or 203.3 per cent as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to February 18, 1932, 27,323 tons, an increase of 4,914 tons or 21.9 per cent

MALAYAN AGRICULTURAL EXPORTS, FEBRUARY, 1932.

PRODUCT.	NET EXPORTS IN TONS.				
	Year 1931	Jan. & Feb. 1931	Jan. & Feb. 1932	Feb. 1931	Feb. 1932
Coconuts, Fresh ...	10,468	1,207	13,217	667	6,658†
Copra ...	100,809	14,207	13,053	6,628	7,559
Coconut oil ..	9,909	1,441	1,711	627	752
Palm oil ...	4,574	508	821	213	429
Palm kernels ...	726	57	170	43	125
Pineapples, canned ...	59,457	10,038	11,936	4,557	6,313
Tapioca ...	28,257	4,216	3,905	1,869	2,024
Gambier, all kinds ...	2,563	383	503	198	255
Arecanuts ...	19,266	3,873	4,400	2,019	1,367
Sago ..	5,133	1,079*	2,901	448*	1,712
Tuba roots ..	74	10	7	5	12

† '000 in number

* Net imports

MALAYAN PRODUCTION OF PALM OIL AND KERNELS.

First Quarter, 1932.

(As declared by Estates)

YEAR AND MONTH	PALM OIL		PALM KERNELS	
	F.M.S.	JOHORE	F.M.S.	JOHORE
	Tons	Tons	Tons	Tons
1932 January ...	359.4	55.7	63.9	7.7
„ February ...	433.8	47.1	73.2	7.0
„ March ...	651.2	121.9	103.5	15.2
Total for First Quarter 1932 ...	1,444.4	224.7	240.6	29.9

The corresponding figures for the first quarter 1931 were:—

F. M. S. ... Palm Oil 840.5 tons; Palm Kernels 141.3 tons.

Johore ... Palm Oil 158.3 tons; Palm Kernels 27.4 tons.

METEOROLOGICAL SUMMARY, MALAYA, MARCH, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE					
	Means of		Absolute Extremes			At 1 foot	At 4 feet	Total	Moist in a day	Number of days				Total	Daily Mean	Percent		
	A.	B.	Max.	Min.	Mean of A and B					Precipitation .01 in or more	Precipitation .05 in or more	Thunderstorm	Fog morning obs				Gale force 8 or more	
	Max.	Min.	°F	°F	°F	°F	°F	°F	in.	mm.	in.	mm.	in.	hr.	hr.	%		
Relay Hill, Kuala Lumpur, Selangor	91.0	71.5	81.3	95	68	74	73	84.0	84.5	16.23	412.3	3.80	18	17	6	184.30	5.95	49
Bukit Jeram, Selangor	88.5	72.5	80.5	92	70	75	75	85.2	86.5	8.06	204.7	1.84	18	12	1	222.65	7.18	59
Sitiawan, Perak	89.2	72.7	80.9	92	69	83	75	84.1	84.4	8.45	214.6	0.94	23	21	2	199.45	6.43	54
Kroh, Perak	88.6	68.7	78.6	92	62	83	72	81.8	81.9	5.99	152.2	1.30	13	12	2	234.50	7.56	63
Temerloh, Pahang	87.4	71.9	79.7	93	67	73	76	83.8	84.5	15.70	398.8	5.25	17	14	2	178.20	5.75	47
Kuala Lipis, Pahang	88.0	71.2	79.6	93	67	77	74	82.6	83.3	10.25	260.3	3.39	17	15	3	177.15	5.71	47
Kuala Pahang, Pahang	85.5	75.3	80.4	87	69	83	79	83.8	84.0	10.83	275.1	4.10	20	19	1	227.15	7.33	...
Mount Faber, Singapore	87.1	73.0	80.1	92	71	77	75	80.9	82.1	7.18	182.4	2.16	12	10	3	191.85	6.19	51
Butterworth, Province Wellesley	88.5	73.3	80.9	91	70	83	75	85.0	84.9	8.12	206.3	1.66	20	15	3	248.40	8.01	67
Bukit China, Malacca	87.6	73.2	80.4	92	71	77	76	83.1	83.9	4.97	126.3	1.60	15	13	2	211.75	6.83	56
Kluang, Johore	88.2	71.5	79.9	94	68	76	74	81.6	82.1	9.38	238.3	1.86	19	14	2	173.25	5.59	46
Bukit Lalang, Mersing, Johore	83.7	73.4	78.5	85	69	79	77	80.5	79.9	12.27	311.7	3.46	13	12	2	221.45	7.14	59
Alor Star, Kedah	93.3	71.5	82.4	97	67	90	74	85.5	85.3	3.08	78.2	1.63	7	6	5	252.15	8.13	66
Kota Bharu, Kelantan	86.6	71.9	79.3	89	64	85	78	81.7	82.6	2.77	70.4	1.07	12	9	3	246.70	7.96	66
Kuala Trengganu, Trengganu	86.1	72.5	79.3	88	66	84	77	82.3	82.8	2.56	65.0	0.62	18	12	1	240.95	7.77	64
HILL STATIONS.																		
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.4	58.4	64.9	76	55	65	60			9.37	238.0	2.23	20	17	3	174.00	5.61	46
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	71.7	56.4	64.1	75	44	67	63	68.3	68.3	9.61	244.1	1.66	20	18	1	155.55	5.02	41
Fraser's Hill, Pahang 4268 ft.	71.5	61.6	66.5	76	59	64	64	71.1	71.1	12.69	322.3	2.25	20	18	1	150.00	4.84	40

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

JUNE, 1932.

EDITORIAL.

Rice Cultivation In Italy.

A close study of the various factors affecting the rice-growing industry in Italy is of more than passing interest to Malaya. Not only is the production of rice of considerable importance in Italy, but the average yields are the second highest recorded in the world. Whereas in Malaya, the average yield of padi per acre is 0.52 ton, in Italy the average yield is 1.87 tons per acre. If it were possible to increase the Malayan yields to the Italian standard, this country would be self-supporting in the matter of rice production without any addition to the existing planted area. In 1931 when the price of rice was unusually low, the net imports of rice into Malaya were valued at \$35,120,159, but the average annual value of net imports for the previous five years exceeded \$60,000,000.

Dr H. A. Tempamy, Director of Agriculture, S.S. and F.M.S. visited the Italian rice areas in 1931, and his report on this subject is included in this number.

Those who are at all familiar with the methods of rice cultivation in Malaya will be able to compare the Italian methods with those obtaining in Malaya and are thus enabled to form some estimate of the extent to which the adoption of Italian methods are feasible in this country.

Conditions in the two countries are necessarily dissimilar in many respects, but it will become evident to the reader that the Italian system is based on a very much more intensive, and therefore more expensive, system of cultivation than that usual in Malaya.

Briefly stated, the Italians procure an average 1.87 tons of grain per acre at a cost of \$170 (Straits currency) whereas in Malaya the yield is 0.52 tons at a cost of \$35 per acre. The former country therefore produces its rice at a cost of about \$90 per ton, while the cost in the latter country is approximately \$70 per ton.

The difference in cost would appear to be to the advantage of the Malayan system of production, but the advantage is more apparent than real. It must be remembered that the Italian daily rate of wage of this work is equivalent to \$1.40 to \$1.85 for men and 70 cents to \$1.80 for women, whereas the usual rates in Malaya are 50 cents for men and 40 for women.

The application of the Italian system to Malayan rice production—if it was possible in all respects and is assumed to be equally productive—would shew a decided decrease in the cost of production in comparison with the present costs in the respective countries.

The success of the Italian system may be summarised as being due to efficient water control, rotation of crops, thorough cultivation, heavy manuring, adequate scientific advice, heavy-yielding varieties of padi and the existence of an intelligent and industrious agricultural population.

The notable difference between this system and the Malayan system is rotation of crops and heavy manuring.

It would seem that the degree by which Malaya can imitate successfully the Italian methods will depend largely on the provision of additional capital—a subject which suggests many difficulties at the present time.

An interesting point is that in the successful contribution of rice-growing and cattle grazing into one rotation, the Italians can claim to have solved successfully a problem which confronts the cultivation in certain parts of north Malaya, notably Kedah and Kelantan.

It seems at least desirable to ascertain whether a definite system of rotation could be alternated in Malaya whereby *sawahs* could be rested in turn from rice and devoted to grazing, and whether such a system would not of itself considerably benefit rice crops and cattle as contrasted with the present system whereby cattle are pastured on the *sawah* during the inter-crop period and pick up a living anywhere they can while the crop is growing.

The main difficulty which lies in the way of the adoption of such a system in Malaya is probably the small size of the individual holdings; on the other hand, the inherent possibilities appear to be well worth investigation.

The Planters Loans Board.

Twelve years ago an article was published in this Journal (Vol. VIII No. 2) which set forth the constitution and objects of the Planters Loans Board, Federated Malay States, with a synopsis of the Board's work for its first four years. Mr. St. L. Parsons, who has been Secretary of the Board from its inception, was the author of that article and he has now, at our request, and with the permission of the Board, revised the statement of the constitution and aims of the Board and added a brief account of the achievements of this scheme, which we have pleasure in including in this number.

The original object of the scheme was to grant loans to planters for the development of their land. Eventually, the scope of the Board's activities was widened to admit of loans being granted for any purpose which was held to assist directly in the general development of the Federated Malay States.

The author is somewhat modest in the brevity of his statement of the achievements of the Board, for which reason and in order to emphasise this

statement we reiterate the facts as stated in the article :—

“ During the sixteen years that the Board has been a corporate body, it has dealt with 1040 applications amounting in the aggregate to \$30,923,000. Loans to the number of 450 representing a sum of \$12,411,000 have been granted. Repayments have totalled \$10,517,000 and the amount outstanding on 31st December, 1931, was \$1,893,000.”

In addition, the Board administered the “ War Service Land Grant Scheme ” which must have entailed much additional work to the Board.

Coastal Soils

In his article entitled “ The Western Coastal Alluvial Soils,” which is included in this number, Mr. J. H. Dennett carries our study of the soils of Malaya, which were discussed in this Journal in 1929, a step further.

In the present instance the author gives an interesting description of the method of formation of the soils encountered at the edge of the inland information.

It is stated that the character of the soils encountered in travelling to the edge of the inland information from the coast are respectively, coastal clays, organic soils and peats. The general characteristics of these three classes are stated and the influence of each on crops is indicated.

Various difficulties encountered in the drainage and other cultural operations on apparently similar coastal lands are explained. A study of this article by those engaged in agriculture within the areas indicated is likely to be of value, because it will shew the amount of drainage necessary and the probable cultural and other operations essential in each case to result in the maximum benefit to the crop and improvement to the soils.

Manuring Oil Palms.

A brief account is given in this number of the results obtained in 1931 of experiments on the manuring of oil palms. This statement should be read in conjunction with the article published in this Journal in March of this year which described the layout of the experiments.

While it is not claimed that the last word has been written in this subject, the article records that there is a definite increase of crop following the application of phosphate manures to 7—8 years oil palms on hill quartzite and peaty soils and that there is no reason to suppose that good results will not follow similar applications elsewhere.

A point which is frequently lost sight of in manurial experiments is the financial consideration. In this case, the authors shew that with palm oil at £20 per ton, an extra return at the rate of £3.9.0 and £6 respectively were obtainable on the two estates on which the experiments were conducted.

Unfortunately, the price of palm oil has now dropped to about £15 per ton, so that the profits of manuring would have been correspondingly less.

The economic aspect of manuring oil palms—and in fact any crop—necessitates a consideration of the price of the agricultural product at the time when the manures may be expected to affect the crop. Admittedly, at the present time such estimates of future prospects are open to doubt, but in the case of edible oils, we must admit that we take a somewhat optimistic view, and therefore consider that the indications of the effect of manuring stated in this paper are likely to bear a favourable relationship to market prices of palm oil.

The Malayan Exhibition.

The decision of the Malayan Agri-Horticultural Association to hold its annual exhibition at Kuala Lumpur during the August bank holidays, which we announced last month, has been favourably commented upon by our contemporaries. The Association's decision is particularly gratifying to its ardent supporters and to others who likewise consider that these exhibitions are of considerable benefit to the country.

The opinion has been expressed in some quarters, however, that the Association is courting disaster by persisting in holding an exhibition this year, because the present trade and agricultural depression will seriously affect the financial stability of the event. We have some personal experience of the financial aspects of past exhibitions in Kuala Lumpur which makes us convinced that the Association, by its decision, has everything to gain and nothing to lose. Even under present conditions, the event should not be a financial failure, while the fact that the activities of the Association can be continued unchecked by the depression of our agricultural industries is proof that it fulfills the objects for which it was formed and therefore justifies the support of the public.

Original Articles.

THE ITALIAN RICE INDUSTRY

BY

H. A. TEMPANY,

Director of Agriculture, S.S. and F.M.S.

The area cultivated under rice in Italy is, in round figures, 140,000 hectares approximately equal to 346,000 acres; the annual production therefrom amounts, on the average to about 6,500,000 quintals of grain (padi) or 650,000 metric tons.

This corresponds to an average yield of 46 quintals of grain per hectare or 1.87 tons of grain per acre, and is the second highest yield in any rice-growing region in the world. The highest yields are obtained in Spain where average returns of 63 quintals per hectare are recorded; the area under cultivation in rice is, however, much smaller in Spain than in Italy and amounts to 48,000 hectares only.

In Italy the crop is produced in a period of somewhat less than six months from the time the seed is sown to the time when the crop is harvested.

In British Malaya the average area under rice cultivation is 669,000 acres and the average crop is estimated to be 350,000 tons of padi or 0.52 tons of padi per acre; the crop takes about 6 months to mature.

If the yields in Malaya could be brought up to the level of those which are obtained in Italy, the average annual outturn from the existing planted area would be about 1,250,100 tons of padi, equivalent to about 750,000 tons of rice, that is to say, the country would be rendered self-supporting in the matter of rice production without any addition to the existing planted area.

Viewed in this light the facts are sufficiently striking to warrant some investigations of the Italian rice industry.

Accordingly, with the approval of the Government of the Federated Malay States, and by arrangement with the Colonial Office, I paid a visit to the Italian rice areas in August and September, 1931, during a period of leave.

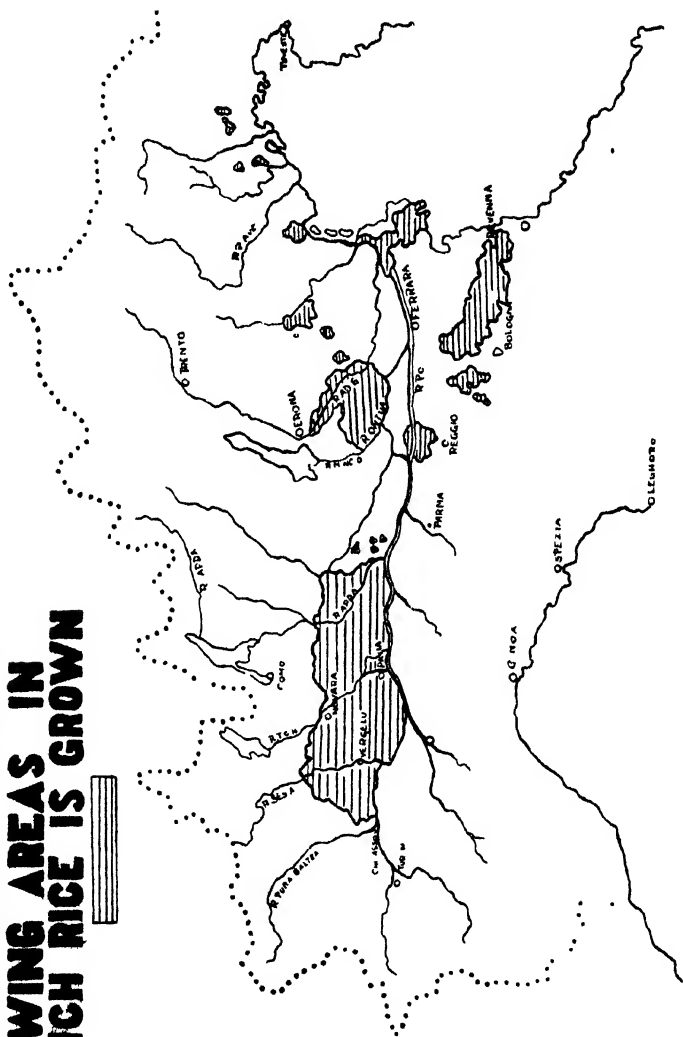
A visit to this region had previously been paid in 1929 by Mr. F. Burnett, formerly Divisional Agricultural Officer, Ceylon, and now Deputy Director of Agriculture in British Guiana, and I had the advantage of being furnished with a copy of this officer's report prior to my departure from England.

During my stay in the rice growing region I made my headquarters in the town of Vercelli, which is the centre of the locality where the rice industry is most intensively developed and the site of the Experimental Station for the rice industry.

After leaving Vercelli I paid a short visit to the International Institute of Agriculture at Rome.

The authorities of the Rice Experimental Station supplied me with very full information and much literature concerning the rice industry and rendered

**NORTHERN ITALY
SHOWING AREAS IN
WHICH RICE IS GROWN**



assistance in seeing conditions in the field.

The authorities of the International Institute of Agriculture supplied some additional data regarding the rice industry and its relationships to Italian agriculture as a whole, they also furnished information regarding the agricultural policy of the Italian Government.

Acknowledgment is made of the large amount of assistance received from these sources.

General.

The Italian rice industry is confined to the northern part of the country, with the exception of certain very small areas in the centre and South, and is mainly contained in the regions of Piedmont, Lombardy, Venete, and Emilia.

The most important area is situated in the provinces of Novara, Pavia and Milan, and lies between Cremona on the east and the River Dora Baltea (a tributary of the Po) on the west; the river Po constitutes the southern boundary of this area while the City of Milan is situated on the Northern boundary. The most important part of this region lies around the town of Vercelli, where the area cultivated under rice is stated to amount to 45,000 hectares, approximately one-third of the total rice area in Italy. Smaller areas exist in the Provinces of Bologna, Mantova, Revigo, Cremona and Alossandria, and still smaller areas at a number of other points. The accompanying map illustrates the geographical distribution of the rice-growing regions and the approximate areas cultivated in the crop in each province.

Typically, the rice areas of northern Italy consist of level plains intersected by numerous rivers and torrents, the majority of which take their rise in the Alpine regions lying to the north and feed the Po, the largest river in Italy, which with its tributaries is in effect the key of the industry, inasmuch as they supply abundant water for irrigating the crop.

The History of Rice Cultivation in Italy.

It seems probable that rice as a crop must have been known to the ancient Romans as the result of their conquests in the East, and that its cultivation, at least in Sicily, existed in very early times. It would appear to have been introduced into northern Italy at some period in the fifteenth century; according to Professor Novelli (Director of the Rice Experimental Station) the first authentic mention of rice cultivation in historical documents occurs in a letter written by the Duke of Milan in 1475.

According to the same authority it appears that in 1540 A.D. there existed in Italy 5,591 hectares of rice, while in 1710 there were 38,644 hectares.

In 1810 the rice fields of Italy are stated to have aggregated 120,000 hectares with production of 1,600,000 quintals, while in 1860 the figure is placed at 145,000 hectares with a probable yield of 2,600,000 quintals.

Following the unification of Italy in 1860, agriculture in general and rice cultivation in particular, received a considerable impetus which was further

assisted by the opening of the Canal Cavour (the largest irrigation undertaking in Italy) in 1866. By 1870 the area cultivated under rice had risen to 232,000 hectares, the maximum ever attained.

About this time the opening of the Suez Canal administered a serious check to the industry inasmuch as it facilitated the competition of Asiatic rice with the locally produced article on the Italian and other European markets. Consequently, the cultivated area tended to diminish steadily during the ensuing years. For the five years immediately preceding the war the average total area cultivated was approximately 145,000 hectares.

During the war years and those immediately succeeding the war, the area diminished still further, partly as a result of labour shortage and partly on account of the invasion of the province of Venetia, and in 1920 the area under rice had fallen to 111,000 hectares. Since then the industry has again extended, and for the years 1929 to 1930 the average area cultivated has been 142,062 hectares.

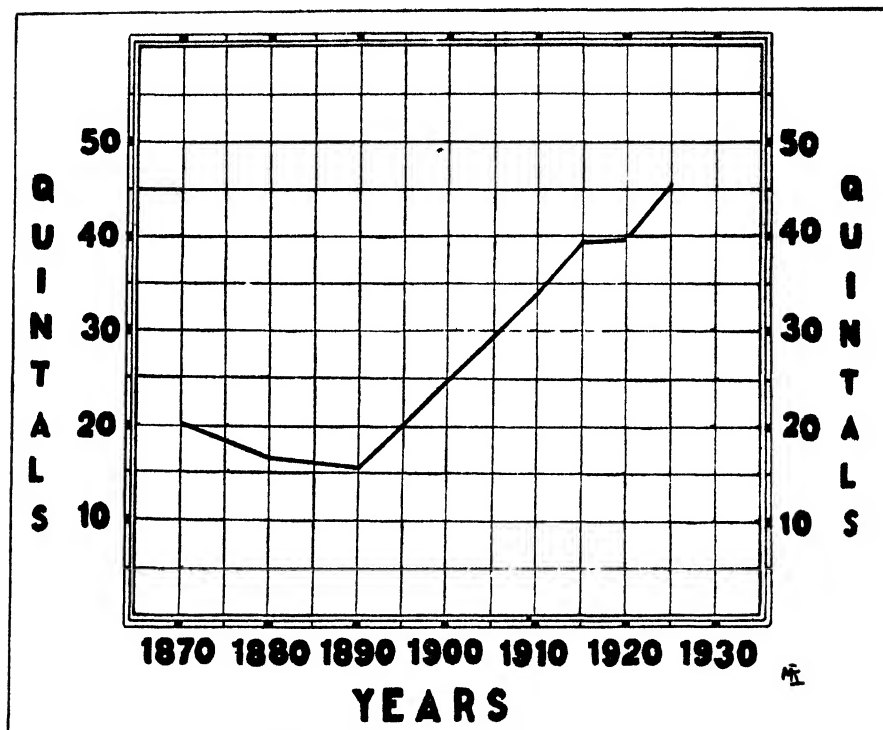
On the other hand, the standard of cultivation and the yield per hectare have steadily increased since the beginning of the present century, as the result of improved methods of cultivation the average yield of grain has risen from 20.65 quintals per hectare in 1870 to 46.0 quintals per hectare in 1925—30, having considerably more than doubled in sixty years, while the aggregate yield has also increased from 4,810,000 quintals in 1870—74 to 6,622,000 quintals in 1925—30.

The accompanying table and graph show the area and production of rice in Italy from 1870 to 1930 in quinquennial periods together with data for individual years since 1925.

Italian Rice Production from 1870 to 1930 in Quinquennials.

<i>Year.</i>	<i>Area cultivated in Hectares</i>	<i>Total Production in Quintals</i>	<i>Yield in Quintals per hectare</i>
1870—74	232,670	4,810,900	20.7
1879—83	201,850	3,584,900	17.8
1890—94	182,450	3,046,400	16.7
1901—05	175,365	4,434,500	24.8
1910—14	144,998	4,878,700	33.6
1915—19	138,616	5,218,300	38.6
1920—24	121,408	4,698,801	39.0
1925—30	142,162	6,621,795	46.0

Italian Rice Production 1870 to 1930
Average Yield in Quintals per Hectare.



Italian Rice Production from 1870 to 1930.

<i>Years.</i>	<i>Mean area cultivated in Hectares</i>	<i>Mean total production in Quintals</i>	<i>Mean Yield Quintals per Ha</i>
1870—74	232,670	4,819,900	20.7
1879—83	291,850	3,584,900	17.8
1890—94	182,450	3,046,400	16.7
1900—05	173,365	4,434,500	24.8
1910—14	144,998	4,878,700	33.6
1915—19	138,618	5,218,300	38.6
1920—24	121,408	4,698,801	39.0
1925—30	142,162	6,621,795	46.0

Annual Production from 1925 to 1930.

<i>Year.</i>	<i>Area cultivated Hectares.</i>	<i>Total production Quintals.</i>	<i>Mean Yield per Ha. Quintals.</i>
1925	143,380	6,416,000	44.6
1926	148,260	6,800,000	45.9
1927	142,180	6,961,000	49.0
1928	134,680	6,315,500	46.9
1929	137,091	6,737,030	49.1
1930	145,981	6,501,240	44.5

Climate of the Rice Growing Areas.

Climatically the rice growing regions possess a typically continental climate showing a rather low rainfall combined with considerable annual variations in temperature, hot summers alternating with cold winters. The total annual rainfall in the neighbourhood of Vercelli averages 735 m.m. with an average frequency distribution of 95 days in the year on which rain fell.

The average monthly rainfall at Vercelli is as follows:—

January	42.7 m.m.	July	56.8 m.m.
February	34.6 "	August	50.3 "
March	50.9 "	September	58.7 "
April	82.1 "	October	81.6 "
May	80.0 "	November	66.0 "
June	75.1 "	December	42.5 "

It will be seen that the wettest months are April, May, June and October, while the driest are December, January and February.

The maximum temperatures occur in July and range as high as 37°C. while the minima occur in January and February when temperatures of from 5° to 10° below zero Centigrade occur. The air tends to be rather humid on account of the large number of rivers and canals and of the irrigated areas, in consequence, fogs are common especially in the autumn. During March the prevalent winds are from the South while in the summer they are from the West. Siroccos occasionally occur.

Soils of the Rice Growing Areas.

The soils on which rice is grown are for the most part alluvial or alluvio glacial in origin. In the Vercellese region alluvio glacial soil types are prevalent throughout except in the neighbourhood of the river beds where they are replaced by recent alluvium.

The soil types generically may be described as a series of more or less sandy clays. In the Vercellese region the soils have been made the subject of an in-

tensive study by Dr. Luigi Boragic of the Rice Experiment Station and the following examples of physical and chemical analyses of soils are taken from his monograph entitled *Il Vercelles*.

The following analyses taken from his monograph entitled "*Il Vercellese*" illustrates the physical and chemical composition thereof.

Physical Analyses.

	No. 1	No. 2	No. 3	No. 4
	%	%	%	%
Coarse earth above 1 mm diameter ...	10.0	5.0	2.5	2.0
Fine earth below 1 mm diameter ...	90.0	95.0	97.6	98.0
Fine earth per cent. composition				
Coarse sand 1.0 to 0.1 m.m. ...	44.0	28.4	10.2	13.5
Fine sand 0.1 to 0.05 m.m. ...	14.2	26.0	20.3	16.0
Sandy clay 0.05 to 0.01 m.m. ...	25.0	29.5	43.0	40.0
Clay—below 0.01 m.m. ...	16.8	16.1	25.6	30.5

Chemical Analyses of Fine Earth.

Moisture ...	1.40	1.34	1.80	1.85
Organic matter (humus) ...	3.40	2.90	3.20	2.90
Calcium carbonate	Trace	Trace	Trace	Trace
Phosphoric anhydride } Sol. in 2 per	0.02	0.02	0.019	0.015
Potassium oxide } cent. Citric Acid ...	0.009	0.015	0.012	0.010
Total nitrogen ...	0.19	0.15	0.17	0.12
Total phosphoric anhydride ...	0.17	0.12	0.15	0.10
Potassium oxide } Sol. in	0.11	0.11	0.07	0.08
Calcium oxide } Conc.	0.49	0.65	0.49	0.60
Magnesium oxide } HCl	0.79	0.67	0.75	0.73
Acidity (pH.) ...	6.6	6.8	6.7	6.5

The lands to the north of Vercelli are, on the whole, rather more sandy in character than those to the south. It is somewhat surprising and very interesting to find that such excellent rice crops are capable of being grown on soils of relatively so light a character.

Chemically the soils are moderately well supplied with nitrogen and potash and fairly rich in phosphoric acid. They are very deficient in calcium carbonate; they are characteristically slightly acid in reaction their pH ranging from 7.0 to 6.6 although acidities up to 6.3 are recorded while still more rarely soils with an alkaline reaction occur.

Irrigation in the Italian Rice Areas.

As has been seen, the rainfall in the rice-growing regions is rather scanty and the crop depends entirely on irrigation for its water supply. There has, in consequence, been developed a very extensive, elaborate and efficient system

of irrigation canals. Some of these are of considerable antiquity, dating back to the thirteenth century, although the early undertakings were constructed mainly to serve the public and military requirements of the cities and for navigation.

Irrigation works to serve the needs of agriculture originated in the eighteenth and nineteenth centuries. All of them obtain their water from the River Po or its tributaries by means of barrages erected across their courses and together they constitute an elaborate network ramifying throughout the rice-growing districts.

The most important is the Canal Cavour opened in 1866 which takes its origin from the Po at Chivasso where an elaborate barrage has been constructed. The canal is 85.3 kilometres in length and has a maximum capacity of 100 cubic metres per second.

In connection with irrigation works, a number of hydraulic elevators and electric power stations have been constructed. Of these the largest is that of Villa Regia on the river Dora Baltea, an important tributary of the Po, at Mazze Canavese. This is the most important electric irrigation plant in Italy; it was completed in 1925; by means of enormous centrifugal pumps the water of the river is elevated to a height of 60 metres above the river and there delivered into irrigation channels. The total power developed by the station exceeds 10,000 H.P. and of this 2,000 is available for industrial purposes and is transmitted to the town of Turin in the form of high tension current. The maximum delivery of water from the undertaking is over 5,000 litres per second.

There are also a number of artesian wells that are utilised to supply water for irrigation.

Irrigation water supplied is paid for by means of water rates. The average cost of water for irrigating a hectare of land is stated to be about 120 lira.

Rice Cultivation as Practised in Italy.

Rice is cultivated in Italy on holdings which vary in size from one up to one hundred and fifty hectares and over. In the Vercellese region rice is grown in the course of rotations on 80 per cent. of the cultivated lands; of the area annually cultivated it is estimated 60 to 65 per cent. is composed of farms of 50 to 100 hectares in extent, 20 to 30 per cent. consists of holdings 2 to 10 hectares in area, the remainder comprising farms over 100 hectares in extent.

It is worthy of mention that the smaller holdings are usually worked by the owners while the larger farms are rented from landowners. The rent for rice lands is usually paid in kind and varies from 10 to 20 quintals of grain (padi) per hectare according to the quality of the land.

Practically everywhere rice is now cultivated as a rotation with other crops; the form of the rotation varies somewhat in different localities but the constituents are usually rice, wheat or some other grain and grass. Formerly rice was cultivated year after year without rotation to a very large extent; it is now considered, however, that this form of cultivation leads to reduced yields owing

to defective soil aeration and consequent disturbance of the microbiological balance in the soil, while a further powerful argument against it is that it is held to increase malaria which was formerly a scourge in the rice areas. It would appear that in part it is the introduction of a system of rotation and the more intensive methods which it has led to which is responsible for the reduction in the area cultivated which has occurred in the past sixty years.

According to Professor Novello Novelli the rotation practised in the Vercellese region is one of seven years duration as follows :—

1st year — Wheat.

2nd and 3rd year Pasture.

4th to 7th years Rice

In the Navarese Lomellina and part of the Milanese region it is an eight years rotation as follows :—

1st year — Wheat or Rye or Maize

2nd, 3rd and 4th years — Pasture.

5th year — Wheat or Rye or Maize.

6th, 7th and 8th years — Rice.

In Emilia and Venetia a four years rotation is followed as follows :—

1st year — Maize or Hemp or Beetroot

2nd year — Wheat.

3rd year — Pasture.

4th year — Rice.

It is interesting to note that, save in a minor degree in Venetia and Emilia where beetroot is sometimes grown, root crops do not appear to enter into the rotation.

Recently the cultivation of rice has become influenced to an appreciable extent by the Italian National Wheat Campaign which aims at increasing the return per acre of wheat lands and lessening the dependence of the country on imported wheat. In connection with it the practice of following a crop of winter wheat with a summer crop of rice is becoming increasingly prevalent in the Vercellese region. Instances are on record where as the result of the application of intensive methods, in a period of ten months the phenomenal yield of 100 quintals of grain i.e. wheat plus rice, have been obtained from a hectare of land.

Normally rice cultivation lasts from the month of March to the month of October. The working up of the land for planting begins in the month of March. The first operation consists of ploughing the land, performed by either disc or mouldboard ploughs drawn by either oxen or horses, or on larger farming units by tractors. Ploughing is carried out to a depth of 18 to 22 centimetres. Formerly a depth of 10 to 13 centimetres was practised, but this is now considered to be too shallow. At the time of ploughing, the principal dykes for the retention of water (batas) are also constructed, running parallel with the direction of ploughing; they are formed by the plough and finished off by hand.

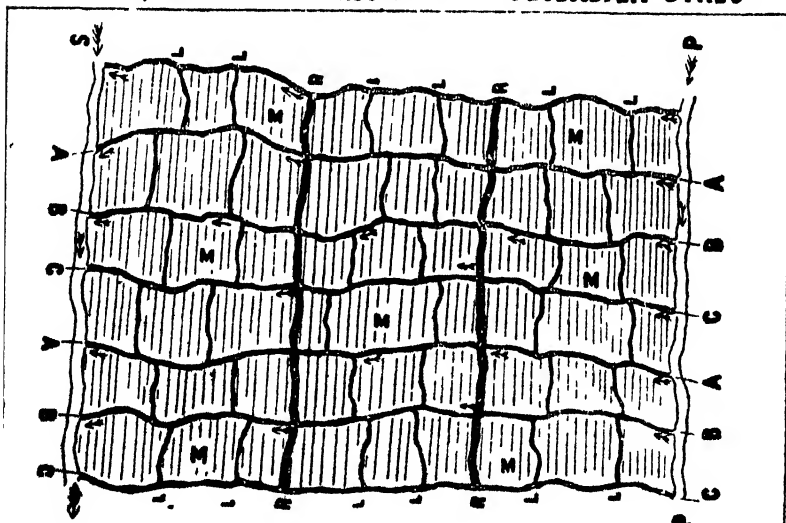
After ploughing, the fields are harrowed to reduce the soils to a fine and

uniform condition and to break up clods; thereafter the cross dykes are made by hand, the water retaining system is closed and water is admitted to the fields. The final levelling is then carried out, great attention is paid to this point as on it depends the satisfactory distribution of the water and the control of the crop. On the lighter lands it is usual to compact the soil and to render it less permeable by means of heavy rollers of stone or iron drawn by an ox.

The last work preparatory to sowing is the passing of an implement known as a "Spianone" consisting of a long plank drawn by a horse on which the driver stands, which completes the levelling. The accompanying sketch reproduced from Professor Novellis work on the Italian Rice industry shows the general lay out of an Italian rice field. In general the size of the water compartment (Malay peta or lopa) is about similar to those seen in Kedah or Province Wellesley and larger than in Kelantan, Perlis or Malacca. The arrangement of the fields is, of course, much more orderly with their regular sequence of irrigation and drainage canals. The general run of the lands is very level reminding me very forcibly of the Malayan rice areas particularly in Kedah and Kelantan. To the latter country the soil type and general physical conditions show distinct similarity.

Diagram of the Lay-out of a Rice Field in Italy.

P	FEEDER CANAL	M	PETAK
S	DRAINAGE CANAL	A,B,C	PRINCIPAL DYKES
R	INTERMEDIATE DITCHES	L	SECONDARY DYKES



Heavy manuring is the universal practice in the Italian rice industry. The combination of grazing with rice cultivation renders available a certain quantity of farmyard manure for use in the industry and this is extensively supplemented by artificial manures. Farmyard manure is applied at the time of ploughing, dressings of artificials are applied partly before and partly after planting. Various mixtures are utilised the formulae recommended by the Director of the Rice Experiment Station being as follows:—

For rice lands which are being planted in rice for the first year after being under grass—

At the time of sowing—

Basic Slag or Superphosphate	...	5	quintals per hectare
Chloride or Sulphate of Potash	...	2	" " "

After the crop has been established and after the first weeding in the month of June—

Mineral Superphosphate	...	3	quintals per hectare.
Sulphate of Potash	...	1	" " "
Sulphate of Ammonia	...	2	" " "

For rice lands which were cultivated in rice during the preceding season—

At the time of sowing—

Basic slag or Superphosphate	...	5	quintals per hectare.
Sulphate of Potash	...	2	" " "
Sulphate of Ammonia	...	3	" " "

After the first weeding in the month of June—

Mineral Superphosphate	...	3	quintals per hectare.
Sulphate of Potash	...	1	" " "
Sulphate of Ammonia	...	1	" " "

Recently calcium cyanamide has begun to assume importance as a source of nitrogen in partial replacement of sulphate of ammonia; it is held that the lime therein contained is of particular value in view of the poverty of the soils in calcium carbonate.

It is not clear, however, how far the efficiency of the dressings given above has been established as the result of systematic experiment or how far they are empirical.

The planting of the crop takes place between April 1st and May 1st; it is performed for the most part, by planting seed directly in the field either by broadcasting by hand or by sowing in drills by means of a machine. In general, sowing by machine is confined to the larger properties.

When sowing is done by hand it is carried out immediately after the passage of the Spianone when the water is still turbid and the land is covered with a thin layer of fine mud which is held to facilitate the germination of the seed and the development of the root system of the young plant. When sowing is performed by machine the land is somewhat drier and is not completely covered with water. The type of machine used is that of a seed drill sowing eight to ten lines at one time. In the Vercellese region sowing by hand still predominates, but

mechanical sowing is considered preferable since it facilitates subsequent weeding and consumes less seed.

When broadcasting by hand is practised 130 to 160 kilogrammes of seed are required to plant a hectare, when planting by machine is employed the amount is 120 to 130 kilogrammes per hectare. Of recent years increasing attention has been directed to the establishment of the crop by transplanting seedlings raised in nursery beds; the practice has been extensively advocated by the Rice Experimental Station. When transplantation is practised, the seed is sown in nurseries at the rate of 550 to 600 kilogrammes per hectare and when the plants are 40 to 50 days old they are transplanted to the fields. It is estimated that one hectare of nursery will give sufficient seedlings to establish about 9 hectares of transplanted rice.

Planting distances for transplanted rice vary somewhat according to the character of the land. It is customary to plant out the seedlings in bunches of 3 to 4 plants per bunch in rows distant apart 25 centimetres and with 25 to 30 centimetres between the bunches.

It is claimed that transplantation induces higher yields, gives a more regular stand, thus lessening supplying and facilitating weeding operations, and shortens the period during which the crop occupies the land thereby rendering easier the planting of preceding crops of winter wheat or leguminous covers which are turned in for the purpose of enriching the soil, while in addition it shortens the period during which the land is submerged which favourably affects the biological conditions of the soil and moreover effects economies in water consumption.

It is stated that in the year 1928 about 10 per cent. of the entire rice crop of Italy was transplanted. At present the work is for the most part performed by hand, women being employed for the operation. The main difficulty in the way of the more extended application of the method apparently lies in the provision of the additional labour. It is claimed that the value of the additional yields and the additional products which can be obtained more than counterbalance the additional expenditure which the process involves.

To obviate the difficulty of labour shortage a number of transplanting machines have of recent years appeared on the market, and in 1926 and 1928 international competitions for transplanting machines were held near Vercelli. There are now about 16 different machines on the market of which three are semi-automatic and the remainder fully automatic, and it is understood that the best are fully satisfactory.

Varieties of Rice Cultivated in Italy.

During the four hundred years in which rice has been cultivated in Northern Italy a very large number of varieties have been grown and many changes have taken place. The origin and nature of the earlier varieties grown is obscure, but it is known that in 1875 the chief varieties cultivated were two in number called respectively the Nostrale and the Bertoni; they were apparently rices of high quality but low productive power which succumbed rather easily to disease.

In the year named a large number of varieties were imported from abroad and from that time until 1906 many varieties were grown which were either imported or had arisen from natural crosses in Italy.

In 1906 the variety *Originarie* Chinese probably imported from Japan a few years earlier, began to assume prominence and it is still the most widely cultivated variety.

With the foundation of the Rice Experiment Station in 1908 the question of rice varieties began to receive more systematic attention and a great deal of breeding and selection work has since then been accomplished.

The methods adopted have consisted in a combination of the importation of varieties from other countries with the systematic improvement of both existing and newly imported varieties by botanical means.

Importations are made regularly by the Rice Experiment Station and the newly imported strains are subjected to trial and judged on the results thereof. It is stated that two or three years are required for imported varieties to become acclimatised to Italian conditions and an opinion cannot be given of the suitability or otherwise of a variety until it has been subjected to trial for this length of time. Importations have been made from the majority of rice-growing countries and have yielded a large number of promising strains.

The reliance which is placed on importations is noteworthy.

Botanical methods employed for the improvement of the crop are threefold and comprise mass selection, pure line selection and hybridisation.

Mass selection is employed very extensively by planters throughout the rice-growing areas for the maintenance and improvement of their crops. It consists essentially in the selection each year of a sufficient number of ears from individual strains to form progeny plots which in turn furnish material for the planting of the general crop in succeeding years. In this work the Station assists.

Pure line selection is carried out by the Experiment Station itself and follows the ear-to-row method which is the basis of similar work in Malaya and elsewhere.

Hybridisation has only lately been embarked on and is at present being carried on experimentally by the Experiment Station; a large number of first and second generation crosses have been established and the attempt is now being made to fix their characters. So far, no hybrid varieties (except a few natural hybrids) have found their way to cultivation, but the work is regarded as of considerable potential importance and it is hoped that it will in due course lead to the establishment of a number of valuable new varieties.

Details of the technique of the methods utilised in both pure line selection and hybridisation have been obtained from the station and are available for reference.

Samples of four of the best strains established by pure selection have been obtained from the Experiment Station and sent to Malaya for trial.

It is noteworthy that owing to climatic conditions all of the rices cultivated have to be of the short maturing kind, and that notwithstanding this, yields obtained far exceed those obtained with long maturing kinds under Malayan conditions.

At present there are about 30 varieties of rice actually under cultivation commercially in Italy, while a considerable additional number are under trial. As stated, the number is constantly being added to by the experimental work in progress. The list of the principal varieties is as follows :—

Common Varieties :

Chinese Originario, Americano 1600, Onsen, Sancino, Sekiama, Precoce Giallo Ardissonne, Precoce Vittoria, Roncarelo and Benlooh.

Semi fine varieties :

Precoce Novella, Precoce Alloric, Lencino, Ranghino, Greppi, Maratelli, Precoce 6, Precoce Dellarole, Chinese Ostiglia, Rosso Gorei and Precoce Americano.

Fine Varieties :

Settala, Nero di Vialone, Ostiglia and Bertore.

Varieties recently selected :

Giros, Sancio No. 9, Tavallini, Vercelli, General Rossi, Riccardo Restano and Precoce San Giacomo.

Cultivation of the Rice Crop after Planting.

Once the rice crop has been established it is kept fully submerged during the period of growth until shortly before the harvest, to a depth of 8 to 15 centimetres. The quantity of water required to mature a crop varies according to the character of the soil and ranges from a flow of one litre per second per hectare for heavy lands to ten litres per second per hectare for light lands, the average for the general run of rice lands in the Vercellese region being from two to four litres per second per hectare. Great importance is attached to the effective performance of weeding operations on the crop, usually three weedings are given during the growth of the crop and the expenditure constitutes the largest single item in the cost of cultivation. The weedings take place at intervals of from fifteen to twenty days during the months of June and July and are performed either by hand or by machine, the employment of weeding machines being only practicable when the crop is planted by machine or is raised from transplanted plants.

For hand-weeding, women are mainly employed and there is a considerable immigration of labour into the rice regions each year for the weeding season.

The reaping of the crop is at present performed entirely by hand, there is no mechanical difficulty in the way of the employment of reaping machinery, but I gather that the main difficulty is that the farming units are insufficiently large and the owners are indisposed to combine for the purpose of operating such machinery collectively.

When reaping the crop the stalks are cut at about 30 centimetres from the ground level and made up into sheaves, which are generally transported to the farm buildings for threshing, on account of the fact that showery weather is by no means uncommon in the harvesting months of September and October.

Male labour is employed for the reaping operations and there is considerable immigration for this operation also.

After transportation to the farm buildings the rice is immediately threshed, mechanical threshers of the ordinary type, usually operated by electricity, being employed. The work of threshing usually proceeds day and night so as to enable the heat of the sun to be used to the maximum possible extent for drying the grain during the rather showery autumn weather.

The greater part of the crop is air-dried on concrete or stone floors, the rice being frequently turned over during drying by means of wooden rakes. At night the drying grain is raked together in heaps and covered over with tarpaulins. The labour involved in drying is performed by women, and the operation is complete in three days. After the drying is completed the crop is winnowed by means of a winnowing machine and subsequently placed in store.

Owing to the liability of showers during the reaping season, some attention has lately been bestowed on the possibility of installing artificial driers for the drying of the crop. One such machine has been installed at the Rice Experiment Station.

After the harvest the crop is held by the farmers and disposed of to the milling factories according to the state of the market during the ensuing months. The milling factories, of which there are a considerable number in the rice growing areas, are owned and operated independently from the farmers. In Vercelli itself there are seven such milling factories.

The farmers are financed by means of advances from the local banks, there are no co-operative organisations for financing the growers or for disposing of the crop. There has, however, I am informed, recently been a move towards the establishment of consortia for the purchase by farmers of fertilisers.

Labour in the Rice Industry.

As will have been seen from the foregoing remarks, both male and female labour is employed in the Italian rice industry. The heavier cultural operations, such as ploughing, making up dykes, sowing and harvesting, are performed by men, while the lighter work, such as finishing dykes, weeding, transplanting and drying the grain is done by women.

The number of labourers employed per hectare, on the average, for the crop varies in different districts; where the cultivation is most intense, as in the neighbourhood of Vercelli, it approximates to 0.72 elsewhere it may run as high as 2.4.

The labour employed falls into two classes namely :—

- (a) labour which is permanently resident in the rice growing districts and
- (b) immigrant labour which is imported into the rice areas each year from about 17 different provinces for the weeding and harvesting operations.

Recruitment of immigrant labour is effected through a central recruiting agency which is situated at Reggio, Emilia.

Engagement of labour is regulated by contract the terms of which have been approved by the Italian Government on lines agreed between the farmers' unions and the labourers' organisations. The contracts provide for the period of the engagement, the number of hours of work per day, the rates of wages to be paid for different types of work and for the payment of health, old age and accident insurance.

The ordinary number of hours per day required from labourers is seven in the winter and eight in the summer; there is also provision in contracts for overtime and piece work.

All farms are required to provide suitable accommodation for resident and particularly for immigrant labour. Consequently all the larger farms are provided with labour barracks which, when they are not occupied by labourers, are used as stores for grain.

Labourers wages range from Liras 15 to Liras 22.50 per day for men and Liras 8 to 21 per day for women according to the type of work that is being done. It may be added that it appears that the operations of harvesting and threshing are not infrequently paid for wholly or in part in kind.

Farms Lay-out and Equipment

The lay out of farms of average size follows a more or less standard pattern. The farm buildings are usually situated more or less centrally to the cultivation and are arranged in the form of a rectangle surrounding a courtyard which is employed during the harvest for drying operations.

The buildings are usually well constructed and comprise barracks, stores, implement sheds, stables for working animals and not infrequently, a byre for dairy cattle as dairying is to a certain extent combined with the rice industry and for this the entrance of pasturing into the rotation provides very well.

Much attention is now paid to malaria prevention in the rice-growing areas; I am informed that this disease was formerly a scourge in this part of the country, but as the result of the preventive measures adopted its incidence has been reduced to almost negligible proportions.

The Economics of Rice Cultivation in Italy.

The cost of cultivating a hectare of rice as established from published figures and from data supplied to me by the Rice Experiment Station appears to be approximately Liras 5,000. The data quoted in different sources vary somewhat *inter se* but the following summary appears to give a fair approximation to accuracy under average conditions.

Approximate costs of cultivating one hectare of rice.

		<i>Liras per hectare.</i>
General charges including rent, taxes, insurance and supervision	...	1,850
Water charges	...	120
Manures and application	...	880
Ploughing, harrowing and making dykes	...	430
Seed and sowing	...	250
Weeding	...	750
Harvesting, transporting and threshing the crop		780
		<hr/>
Total	...	5,060

Reference to the table on page 277 will show that the average return for the past five years for the whole area cultivated in rice in Italy has been 46.0 quintals per hectare, while in individual years the returns have ranged between 44.6 and 49.1 quintals per hectare.

The market price for unhusked rice at the present time lies between 50 and 60 liras per quintal, the actual average for the year 1930—31 to March being Liras 58.30. At this value the industry is being carried on at a considerable loss. It is, however, to be noted that the market for rice is very much below the normal level as the result of the world depression and that under normal conditions prices range between 120 and 140 liras per quintal and at this figure, on the basis of costs indicated above, the cultivation of rice yields a profit of Liras 1,000 to 2,000 per hectare when a yield of 50 quintals per hectare is obtained.

The market for the crop lies partly in Italy and partly in other countries, the percentage of exportation being about 25 per cent of the entire crop. The main countries to which exportation takes place are the Argentine Republic and Chile.

Pests and Diseases of the Rice Crop.

The Italian rice crop is stated to be little subject to pests and diseases, the only serious malady which occurs being a form of stem rot.

Stem borers apparently do not occur, at any rate, as a serious pest.

Rats are liable to occasion considerable damage if uncontrolled, they are combatted by systematic trapping and poisoning. The most efficacious poison has been found to be zinc phosphide which is sold commercially in considerable quantities for the purpose of destroying rats in rice fields. It is employed mixed with broken rice in the form of a paste which is made up into balls and distributed along the dykes in the rice fields. The formula used is as follows :—
zinc phosphide 1 kilogramme, broken rice 20 kilogramme, water 3 Litre.

Fish Culture in Connection with the Rice Industry.

An interesting adjunct of the rice industry is the raising of carp, which is carried out to some extent in the rice fields on lines somewhat parallel to the manner in which it is conducted in Java.

The young fish are liberated in the rice fields soon after the water has been admitted thereto and are allowed to remain therein until the water is drained off just prior to the harvest, at which time they are lifted and transferred to basins specially dug for the purpose of containing them during the winter months. They are retransferred to the rice fields in the ensuing spring when the water is readmitted thereto.

It takes three years for such a fish to come to maturity and when mature they weigh from three to four pounds.

Efforts are being made further to develop the industry and in this the Rice Experiment Station assists by raising and distributing young fish.

The Experiment Station of the Italian Rice Industry at Vercelli.

This organisation was founded in the year 1908. It is supported partly by interest on a central fund which was created after the war and partly by contributions from the various rice-growing districts—from the farmers, syndicates etc. Its affairs are administered by a Board of Direction and there is also an Executive Committee. Its work is in charge of a Director, while there is an Assistant Director who is also chief of one of the Divisions. The station is organised in five divisions namely:—Botanical, Chemical, Engineering, Agricultural, and a Division of Fish Culture.

Each Division is under the charge of a Divisional Chief with one or more trained Assistants, save that at present the head of the Botanical Division is also in charge of the fish breeding work.

The head-quarters of the Institution are situated in the town of Vercelli and comprise laboratories for Chemistry and Botany, together with Offices, Library, Museum and Board Room.

The field experiment station is situated three kilometres outside of the town and comprises about 40 hectares of land with office, labourers' barracks, stores, implement sheds, pot culture shed, field laboratory for botanical work and a byre which accommodates about twenty cattle. Some additional buildings are in course of erection and it is intended in due course to transfer the botanical laboratories to this site.

The work of the station concerns itself with breeding, selection, acclimatisation and trial of varieties of rice, with manurial experiments, with chemical and physical work on soils and on rice itself, with agricultural engineering problems including irrigation, farm machinery and the like and with fish breeding work.

Latterly the station has also undertaken a certain amount of research in connection with the National Wheat Campaign with special reference to the wheat-rice rotation already referred to.

The institution also gives advice to farmers in connection with problems affecting the crop, assists them in relation to the mass selection of seed on farms and carries out a large number of co-operative experiments on properties throughout the rice-growing area of Italy.

There is no special section of the Institute devoted to the study of questions connected with the pests and diseases of the rice crop; as stated, these are at present considered to be of minor importance; when such questions arise, assistance is invoked from the experts attached to the Agricultural Institutes at Milan or Turin.

The results of the work of the station are published in an excellent series of monographs, while a small periodical dealing with agricultural questions and research in connection with the rice industry together with occasional leaflets are also issued.

It is considered that the station has played a very important part in assisting to bring about the very marked improvements in Italian rice cultivation which have occurred during the past twenty-three years.

It constitutes an excellent example of the single crop type of experiment station.

Summary and Conclusion.

This concludes the outline of the conditions under which the Italian rice industry is conducted. At present, in common with practically all other agricultural industries, it is suffering from the effects of the world depression, but in normal times it is productive of adequately remunerative returns.

It constitutes an example of the manner in which an industry, which has in the East, at any rate until quite recently, been exclusively regarded as capable of successful prosecution only by Asiatic agriculturists with a low standard of living, can hold its own under natural conditions which cannot be regarded as ideally suited thereto, can be operated with relatively highly paid European labour and can yield considerable profits as the result of the application of intelligent and progressive methods.

It is interesting to compare the data with those adduced in relation to the Australian rice industry and to the attempts at mechanised rice cultivation in Southern Siam lately published in the *Malayan Agricultural Journal*, also with the accounts of the rice industry in California and the Southern States of America in Copeland's well-known book on rice.

The conditions which have led to the present high returns in the Italian industry may be summarised as follows:—

1. The provision of an effective system of water control which allows of water being got on and off the fields when crop conditions require it.
2. The working out of a rotation system which allows of the lands being rested from rice cultivation periodically with consequent benefit to the biological conditions of the soil.

3. The provision of deep and thorough cultivation.
4. The working of a system of regular and heavy manuring.
5. The provision of heavy-yielding varieties suited to the conditions under which the crop is grown.
6. The provision of adequate scientific advice and guidance for the industry through the Rice Experiment Station.

That these results have been possible is due to the existence of an intelligent and industrious agricultural population.

Provided that the conditions set out above can be satisfied there is no obvious reason, so far I can see, why equally satisfactory yields should not be capable of attainment in Malaya for example.

References.

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3. The wheat campaign in Italy. Statement issued by the Italian Ministry of Agriculture and Forests 1931.
4. II Vercellese. Studi e ricerche sui terreni e sulle acque d'irrigazione by Dr. Laigi Boragio 1929.
5. Le Macchine Transplantatrici per Riso 1929 by Ing Giovanni Sanpistire.
6. Le Varieta di Riso coltivate in Italia, by Dr. Riccards Chiapelli, 1930.

APPENDIX I.

Units used in the Report.

1 Hectare	=	2.47 acres.
1 Quintal	=	100 Kilogrammes.
1 Kilogramme	=	2.205 English pounds.
1 Metric Ton	=	1,000 Kilogrammes.
	=	10 Quintals.
	=	2205 English pounds.

Exchange rate on Gold standard £1 = 92.46 Liras.

Actual exchange rate at time of writing £1 = 75.125 Liras.

THE PLANTERS LOANS BOARD.

Federated Malay States.

BY

D. St. L. PARSONS,

Secretary, Planters Loans Board.

The Planters Loans Board, Federated Malay States is Incorporated by Enactment No. 27/1915: Amending Enactments No. 15/1920 and No. 6/1926.

The Government of the Federated Malay States originally decided to lend financial assistance to the development of the agricultural resources of the country in the year 1905.

Little, at that time, was known of the fertility of the virgin soil of the country and the estates in actual being were few and far between.

Applications for assistance for the first 2 to 3 years were negligible but as time progressed and the prospects of the successful cultivation of the Para rubber tree and the coconut palm became more widely known, with the alienation of considerable tracks of country for the purpose, bringing an influx of capital and a largely increased population, these industries—particularly rubber—rapidly assumed considerable importance. People—of all nationalities—already in the country, began to take a keen interest in the cultivation of rubber and, with the great development work going on all round and the evident desire of all to extend their interests, the Government system of loans to agriculturists steadily expanded, to such an extent that the Administration found itself somewhat seriously handicapped in coping with the situation.

With a roll of 136 estates—large and small—benefiting from loans to the extent of nearly \$4,000,000 and applications still coming in, Government, towards the end of the year 1913 decided it would be expedient to put the whole system of loans on a better footing and, with this end in view, appointed an Advisory Board to review the position and handle all new applications.

This Board which consisted of:

The Director of Agriculture, S.S. & F.M.S. (*Chairman*)

The British Resident of Selangor

Two leading Planters

and the head of one of the largest mercantile concerns in the country came into being early in 1914 and one of the first steps taken was to advocate the engagement of a permanent staff. Government adopted this recommendation and the necessary staff was engaged in May of that year.

This Board continued to serve in an advisory capacity until towards the end of the year 1915 when a special enactment was introduced and passed in Council creating it an executive body under the style and title of

“The Planters Loans Board, Federated Malay States”.

Constitution.

The Board, as such, is a body corporate and has continuous succession and

has and may use a common seal and may acquire, hold dispose of and otherwise deal with movable and immovable property and may sue and be sued in all Courts and in all manner of suits and proceedings and may do all matters and things incidental to or pertaining to a body corporate.

The members of the Board, who shall number not less than 3 nor more than 7, are nominated by the Chief Secretary to Government, Federated Malay States.

A member ordinarily retains his seat for a period of 5 years, unless expressly nominated for a shorter period, but he is at liberty to resign at any time and also, he may be re-appointed for a further term of service.

Members who absent themselves from the Federated Malay States for a period exceeding 2 months are deemed to have resigned their seats.

Not more than half the members may be officers employed in the Public Service.

The Chairman of the Board is nominated by the Chief Secretary to Government, Federated Malay States.

All nominations must be published in the F.M.S. Gazette.

The Chief Secretary to Government, Federated Malay States has power to remove any member from the Board or from the Chairmanship at any time by notification in the Gazette.

Funds.

The capital of the Board is \$4,000,000, a sum set aside, by special resolution of Council, from public monies for the purpose.

The Government Treasury acts as Bankers to the Board in so far as the Board draws on the Treasury for its requirements (subject to the limit of \$4,000,000). Inversely, all monies collected by the Board are paid in to the Treasury.

Loans.

Up to the year 1920, the grant of loans was restricted to one class of borrower only *viz*: "Planters" (Planting Companies, Syndicates and Individuals) but during that year the powers of the Board were extended to permit of loans to Co-operative Agricultural Societies and to small native Agriculturists. Again, in 1926, the scope of the Board's activities was further extended to admit of loans being made for any purpose, which in the opinion of the Board, would directly assist in the general development of the Federated Malay States.

The grant of loans is restricted exclusively for the benefit of land situate within the Federated Malay States.

In the case of agricultural loans, assistance is given, as a general rule, expressly to help immature properties to reach the producing stage and/or to equip them, with buildings, plant and machinery.

The usual procedure is to issue such loans by monthly instalments on production of accounts for the preceding month and instalments may be withheld at any time if the Board has any doubt that the money is being improperly

expended or if the property is adversely reported on.

The terms usually prescribe for "repayment on demand" which enables the Board to call in the loan at any time if it is dissatisfied, but generally speaking, repayment is not demanded until such time as this is possible out of income derived from the land.

Urban and other loans are granted for fixed periods, repayable, as a general rule, by half yearly or yearly instalments based on the earning capacity of the property under charge.

Interest.

Interest on loans is charged by the Board at such rate or rates as may be in force at the time of making the loan.

The scale of rates is prescribed by the Chief Secretary to Government, Federated Malay States.

The usual rates for agricultural loans are 7½ and 8 per cent. and for urban and other loans 6 per cent.

Of the interest collected, 75 per cent. is credited to Public revenues while the remaining 25 per cent. is retained by the Board towards meeting its administration expenses and the creation of a reserve fund to cover possible bad debts.

Security.

The security required for all loans is a charge, registered under the laws of the Federated Malay States in force for the time being, of the land for the benefit of which the loan is made and, in the absence of any express stipulation to the contrary, the following conditions, in so far as they apply, are by law implied in all charges :--

- (a) that the chargor will properly and judiciously use the moneys secured by the charge for the purposes for which the same are by the terms of the charge expressed to be advanced to him and will not use such moneys for any other purpose whatsoever
- (b) that the chargor will pay at the times and in the manner required by the terms of the charge all amounts accruing due thereunder, whether by way of interest or otherwise
- (c) that the chargor will duly comply with all conditions and obligations attaching to the title for the land charged, whether in respect of cultivation, building, payment of rent or otherwise, and will keep all buildings on the said land in good repair
- (d) that the chargor will not transfer to any other person any portion of his interest in the land charged without the written consent of the Board under its common seal
- (e) that the chargor will furnish month by month to the Board proper accounts of revenue from and expenditure on the land charged and such other information as the Board may from time to time require

- (f) that the chargor will insure and keep insured in the name of and to the satisfaction of the Board all buildings, machinery and plant in or upon the land charged, except such as may be exempted by agreement, and all produce of the land charged from the harvesting of such produce until the sale thereof and that proper evidence of such insurance shall be produced to the Board from time to time as required
- (g) that no dividend or bonus shall be paid to any person out of the profits arising from the land charged until all moneys secured by the charge shall have been paid to the Board in full
- (h) that all profits arising from the land charged which are not required for the due cultivation and maintenance thereof shall be devoted to the payment to the Board of the moneys secured by the charge
- (i) that the chargor will pay to the Board on demand all expenses which may be from time to time incurred by the Board in or about the employment of a person or persons to visit, inspect and report on the land charged
- (j) that the chargor will pay to the Board on demand all costs, charges and expenses whatsoever which may be paid or incurred by the Board in any exercise of its rights or powers occasioned by default of the chargor in the observance or performance of any undertaking or condition expressed or by the Planters Loans Fund Enactment or otherwise implied in the charge
- (k) that no part of the land charged which is not cultivated at the date of the execution of the charge shall without the written consent of the Board under its common seal be cultivated until all moneys secured by the charge shall have been paid to the Board in full

Any special conditions may be imposed and inserted in the charge.
Collateral security may also be required.

Inspections.

All properties benefiting from loans are periodically inspected and reported on for the information of the Board. The cost of these inspections is payable by the borrower (see ~~clause~~ (i) in preceding paragraph).

Accounts.

Full accounts of all transactions are kept by the Board which are subject to audit by such person or persons as may be appointed for the purpose by the Chief Secretary to Government, Federated Malay States and the Board renders to Government each year, before the 31st of March, a balance sheet and relative documents setting out the position of all loans at close of business on the 31st day of December in the previous year accompanied by a report on the year's working

General.

There is little doubt that the policy of Government in inaugurating a system

of loans to planters and others tended towards the more rapid development of the country than would, otherwise, have been the case and, at the same time, proved of considerable assistance to the borrower. It is believed that there must be many residents—past and present—who have good reason to be grateful for the Administration's foresight in creating facilities for aid being rendered in times of stress and assisting them through their difficulties. In general, this applies to all time and in particular to

- (a) the year of the outbreak of the Great War (1914) when the financial situation became so difficult that many owners of properties would have gone to the wall had it not been for the assistance given by the Board.
- (b) Again, the year 1918 when, owing to the uncertainty of the situation and the ruinous prices obtaining (mainly through lack of shipping facilities as the result of the Great War) the rubber industry passed through a nerve racking crisis
and
- (c) yet again, the rubber slump 1920—1923.

With the imposition of the "Restriction of Rubber Exports Enactment 1922", the Board decided that the time had arrived for it gradually to withdraw from rendering further assistance to the rubber industry and in pursuance of this policy, fewer and fewer applications from owners of rubber lands have been entertained each year, the Board finally closing down on "rubber" in the year 1929 though a number of rubber properties still remain on the Board's books.

During the 16 years that the Board has been a corporate body, it has dealt with 1,040 applications amounting in the aggregate to \$30,923,000. Loans to the number of 450 representing a sum of \$12,411,000 have been granted. Repayments have totalled \$10,517,700 and the amount outstanding on 31st December 1931 was \$1,893,300.

War Service Loans

The foregoing takes no account of the loans made by Government to returned ex-soldiers under the "War Service Land Grant Scheme", a scheme formulated by Government in the year 1920, for assisting men, previously in employment in Malaya, who took part in the Great War.

This scheme provided for a free grant to each individual of 100 acres of land, on special terms as regards quit rent, with a loan to those requiring assistance up to a limit of \$250 per acre at 6 per cent. per annum, subsequently reduced (from 1st July 1925) to $4\frac{1}{2}$ per cent. per annum.

Government's commitments under this scheme amounted to \$3,500,000 of which approximately one half, so far, has been repaid.

The administration of these loans was placed in the hands of the Planters Loans Board.

THE WESTERN COASTAL ALLUVIAL SOILS

BY

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In a previous article, a general description was given of the characteristics of the three more important inland soil types—*viz.* The Quartzite, the Granite and the Raub Series. In this paper it is proposed to deal in a similar manner with the soils of the coastal belt from Province Wellesley to the Negri Sembilan border.

The coastal alluvium is the youngest formation in Malaya both from the geological and the soil standpoint. Compared with other soils in this country it is unique in so far as there is no practical differentiation to be made between the soil as such and the geological formation. There is no parent rock underlying this soil, which may be pictured as continuing to great depths * ultimately overlying rocks with which it has no generic connection.

The inland soils formed (in the first instance by the weathering of parent rock) *in situ* undergo a continual process of erosion chiefly by the agency of water, the eroded matter finding its way to the rivers and the sea. The comparatively large particles of sand will tend to move along the swift-moving storm streams into the rivers and remain on the river bed, the current generally not being swift enough to move the large sand particles far. The silt particles being smaller, tend to be carried further and to be deposited nearer the river estuaries. The finest particles of all, clay, tend to be carried right to the river mouth where the influence of the salt sea water causes the fine particles to flocculate and be deposited on the sea floor until with the deposition of layer after layer of clay, fresh land is formed, to which the name coastal alluvium has been given.

There are certain possibilities with regard to the coastal alluvium which may be deduced from the general geological formation of the country. Reference to the map published in the *Malayan Agricultural Journal* for July 1929 will shew that there is a main range of granite hills running more or less parallel to the coast and extending roughly from latitude 6° N to 2° 30' N. These hills are bounded on the west by undulating land of quartzite formation with breaks in the neighbourhood of Kulim, Taiping, Tapah and Seremban. To the west of the quartzite lies the coastal alluvium stretching in an unbroken belt of varying width (5 to 50 miles wide) from Central Kedah to the Selangor—Negri Sembilan boundary.

* Soil is here-used in accordance with Dokutschajeffs definition "The layers of material lying on or near the surface of the earth which has been changed by natural processes under the influence of water, air and living and dead organic matter." This does not necessarily coincide with the agricultural conception of a soil.

There are a number of exceptions to this unbroken belt of alluvium, sandy beaches occurring at Morib, Jeram, an area seven or eight miles north of the mouth of the Sungei Tinggi, various parts of the Dindings, Malacca and Port Dickson. The last two places are outside the limits laid down above and so will not be considered here.

For the rest there are especial circumstances giving rise to the beach in each case.

Off the Jeram coast are a number of islands of quartzite formation and close again on the mainland is a quartzite hill, obviously an island until joined up by the deposited alluvium. This hill is in its turn being eroded and while the smaller particles tend to be carried far away, the larger sand particles are deposited close to the hill, at Jeram. Further, the tide and currents bring in sand eroded from the islands just off the shore while a third factor tending to the formation of a sandy beach at this point is deposition of sea shells brought in by similar agency.

The beach near Sungei Tinggi can be seen to consist entirely of ground up sea shells apparently deposited there by inflowing currents.

In the Dindings is a case of granite islands finally joined to the mainland by the deposited alluvium and now the granite undergoing erosion, deposits its large sand particles close at hand on the beaches, while the finer particles eroded are carried further out and deposited on the sea floor.

Morib presents a case where the sandy beach is very thin, the alluvium being encountered at one to six inches below the surface of the sand. The most probable origin of the sand is Jugra Hill some miles away, the sand having been conveyed to Morib by south-easterly currents.

It would be anticipated therefore that there is probably much resemblance between the coastal alluvium of the north and south, with modifications as one travels westwards from the junction with the inland formations.

These modifications may be quite considerable within the main soil type of coastal alluvium.

Generally speaking, the soils encountered in travelling to the edge of the inland formation from the coast are —

- (a) Coastal clays
- (b) Organic soils
- (c) Peats.

These three soils together constitute the coastal alluvium, but each have certain readily distinguishable characteristics.

The balance of evidence indicates that the soil of the coastal alluvium formation which was first to appear was the coastal clay somewhere within a mile or so of the neighbourhood of the present sea board. Such early coastal clay probably formed a bund giving rise to a lagoon between itself and the quartzite. The lake so formed presented the proper conditions for the formation of peat. Reeds and sedges probably first made their appearance along the margin further modifying the system while forest litter came in from the neigh-

bouring quartzite with the formation of marsh conditions along the edges permitting of a marshy forest vegetation. There was probably a rapid rate of mortality (but not of decay) among the flora of this region, their remains (which can be found in any peat area) further tending to fill the lagoon and enabling vegetation to spread nearer and nearer the centre until at last the lagoon as such disappeared leaving a peat marsh to the east and a clay marsh to the west. There would be an area between these two where there would be a great tendency for the organic peat to become mixed with the clay, giving rise to marshy land with intermediate properties. This is the area of the present organic soils.

Similar deductions have been made in connection with the Bera Lake. Pahang. This area of twelve square miles of swamp and semi-swamp has gradually been brought to its present condition from original deep water by the pioneering efforts of the water growing rasau (*Pandanus helicopus*). This grew on the border of the original lake and formed a barrier for the silt brought down by streams until other tree growth appeared on the area thus consolidated. the rasau gradually advancing as semi swamp conditions were brought into being behind it.*

Coastal Clays.

Under natural undrained conditions the surface soil of the coastal clays is usually grey in colour changing to a blue or a blue green at the level of the permanent water table. On land which has been drained, the soil is modified to a yellow, presenting mottling of a brick red. Such modification of the soil under good conditions of drainage is rapid. (A sample of blue clay kept in the laboratory more or less under field conditions has passed from the blue through the grey to the yellow-red state in a period of some nine months. Samples of blue or grey clay which have been air-dried and kept in bottles have taken up a uniform yellow colour.)

Within a mile of the coast, shallow layers of peat may be encountered at depths varying from one to three feet, and never more than a few inches in thickness, usually with blue clay and a permanent water table immediately below. This seems to indicate possibilities of the surface layers being of considerably more recent origin.

Where present day plant remains occur in the subsoil there is usually a strong smell of sulphuretted hydrogen and organic sulphur compounds particularly noticeable where such remains consist of nipah roots, as much as 0.35 per cent. having been recorded. There is probably also sulphur present as iron pyrites. Such soil is usually very acid (pH3.0 and below) the acidity usually increasing with aeration due to the conversion of the sulphur compounds to free sulphuric acid.

Beds of sea shells are frequently encountered as far as two to three miles

* The Malayan Forester Jan. '32 page 103 "The Bera Lake".

inland at depths varying from four to ten feet, indicating possibly a coast line of mesozoic times.

The coastal clays, contrary to expectation, shew a considerable variation in texture though from casual inspection they all appear heavy. The variation is due almost entirely to the quantity of fine sand present. As far as the area between Province Wellesley and Negri Sembilan is concerned, all the light soils are situated in South Selangor. This may be due to old river beds which have meandered over this area and possibly to some extent to the fact that towards its southern extremity the coastal formation adjoins the Raub Soils and not the quartzite.

		Clay	Silt	Fine sand	Coarse sand	Loss on Ignition.
<i>Averages for the heavier soils are :</i>						
At surface	...	50	30	12	less than 1	14
At 30 inches	...	55	27	10	less than 1	10
<i>Averages for the lighter soils are :</i>						
At Surface	...	25-15*	20	50-60*	less than 1	10
At 30 inches	...	40-30*	20	35-45*	less than 1	10
<i>The limits encountered are :</i>						
Heavy Soil	...	70	22	3	Nil	11
Light Soil	...	14	30	55	Nil	5

From chemical analysis the coastal clays appear considerably richer in ultimate plant nutrients than soils of the inland formations. As results rather shew that in this country the available nutrients are a definite portion of the "total", (HCl extract) the coastal soils therefore tend to have considerably more nutrients in an available condition. The lighter soils tend to be poor in this respect.

Typical "total" percentage figures are as follows:—

	Lime (CaO)	Potash (K ₂ O)	Phosphates (P ₂ O ₅)
Heavier Soils (Coastal)	0.13	0.80	0.04
Lighter Soils (Coastal)	0.02	0.20	0.02
Quartzite (Inland)	up to 0.05	up to 0.10	up to 0.02
Granite (Inland)	up to 0.04	up to 0.05	up to 0.02

Chlorides vary with geographical position and drainage. The maximum encountered on a heavier soil nearer the coast was 0.4 per cent. and the minimum occurring in the centre of an alluvial area was nil.

* Double figures shewn as the general variation is much greater than in the heavier soils.

Peat.

The peat belt (i.e. where in undrained condition there is at least three feet depth of peat on the surface) lies contiguous to the quartzite on the east, the distance of its western limits from the sea shewing such a large variation that it is quite impossible to give a figure. It is doubtful, with the possible exception of the unexplored hinterland of the Sungei Tinggi, if it ever becomes more than about eight miles wide, while in parts the belt dwindles away where the quartzite come unusually near the sea. In such cases the quartzite is immediately in contact with the coastal clay.

The peat is usually a brownish black at the surface and a reddish black below becoming increasingly ruddy and finer in texture with increasing depth.

The average moisture content of peat in the field is about eighty per cent. on a wet basis while over eighty per cent. of the dry material is organic, that is to say that four per cent. or less of the weight of a freshly taken sample will remain after ignition. It is usually very acid (pH suspension circa 3.0 or below).

Microscopically the higher strata of the peat shew a cellular woody structure with considerable resinous inclusions, but by the time a depth of four feet has been reached this structure is not pronounced. Depth is known to vary between three and forty feet, the underlying soil varying from quartzite clay to coastal clay according to the position at which the sample is taken.

Organic Soils.

These soils lie geographically between the peat and the coastal clay. In properties they may be considered as intermediate between these two formations. They are really coastal clays containing over twenty per cent. of organic matter, the latter probably being originally present as intermixed peat.

General Cultural Characteristics.

The western alluvial coastal belt can be regarded as the richest soil *per se* in Malaya. Owing to the nature of its formation, however, the land is flat and most of the soil is heavy so that chemical richness is balanced to some extent by difficulties of drainage.

Where adequate drainage is possible, coconuts and rubber thrive well while the alluvium of the Krian district testifies to its possibilities for padi, though this area may be regarded as rather exceptional being abnormally rich in phosphate.

As pointed out above, the coastal clay can shew a fairly wide range of composition both physically and chemically but owing to the fact that these differences are largely due to the presence of varying amounts of fine sand it is extremely difficult to judge the properties of a coastal clay on its appearance in the way that the value of an inland soil may be appraised.

The inability to recognise in the field difference in mechanical properties has given rise to many difficulties on certain coconut areas. It has been a matter

of observation in the laboratory that where analysis shews large amount of fine sand, poor coconuts are found, and in many cases it appears highly probable that poor growth has been accentuated by the fact that these soils (containing fine sand) have been given exactly the same drainage as soils which look similar but which, in point of fact, are of much heavier composition.

The question of soil acidity is of great importance with coastal soils owing to the great variation encountered. Further, it rarely happens that the pH value is constant through any given profile but generally shows either increased or decreased acidity with depth.

On peat areas most permanent crops seem to thrive well during their early stages, shewing much better growth than the neighbouring non-peat areas. On these areas shewing good early growth it only too frequently happens that crops such as coconut and oil palm subsequently become very sickly. It appears that during the early stages the roots are thrust deep into the peat and after a year or two they encounter the water table which usually occurs at the junction of the peat and the underlying clay. If, on the other hand, peat is well drained before planting it rapidly shrinks to a dry powder which it is almost impossible to recondition. It is therefore necessary to drain such areas slowly but rather in advance of the rootings, so that when the roots reach underlying clay they will be above the water table. This is only possible where the underlying clay is friable. When the clay is of the heavy blue variety it acts very much like a smooth concrete drain, the water tending to run over it rather than permeate through it to reach a lower-lying drain.

Where peat is very deep, such that underlying clay is not reached after careful draining to a considerable depth, no crop seems to thrive with possible exceptions in rubber and pineapples and these only to a moderate degree. The pineapples, though large, tend to be coarse and acid, the rubber weedy with abnormal lateral rooting.

The best of the peat area seems to be where it is contiguous to the quartzite and has to some extent become intermixed with it. In this narrow belt most crops appear to thrive, the appearance being much superior to that of similar vegetation on either the neighbouring peat or quartzite.

The organic soils which present a mixture of a clay and ancient peat have not the cultural character of the quartzite peat mentioned in the last paragraph but they have the advantage over the coastal clay of being much more readily worked. Excessive drainage is to be avoided.

In conclusion it may be remarked that although this article is based on detailed observations only between the limits of Province Wellesley and the Negri Sembilan border, isolated samples received from coastal alluvial areas in Kedah, Malacca and Johore are in agreement with the observations made in this article.

OIL PALM MANURIAL EXPERIMENTS*

A general description of the layout of the Departmental experiments has been given in the *Malayan Agricultural Journal* for March 1932. Demarcation of plots, application of manures, recording and supervision have been carried out by the Agricultural Division.

Manures were applied in July and August 1930 and gave no significant increases for the second half of that year.

Results for 1931 are shown below, expressed as weight of fruit (bunches) per mature tree and as percentages of the controls. Figures per mature tree rather than per plot have been used in order to overcome the inaccuracy which would have been introduced into the latter figures by the presence of supplies. The majority of plots contained 9 or 10 trees in July 1931, only a few falling as low as 7. Had plot yields been used the conclusions drawn below would not have been affected.

Yield 1931 (in lbs. of fruit (bunches) per mature tree).

<i>Treatment</i>	<i>Estate A</i>	<i>Estate B</i> (On organic soil)	<i>Serdang</i>
Nitrogen, Phosphate, Potash (NPK)	221	182	
Nitrogen, Phosphate, Potash, Magnesium (NPK Mg)	260	145	179
Phosphate, Potash (PK)	199	169	
Phosphate, Potash, Magnesium (PK Mg)	200	213	237
Phosphate (P)	243	233	
Phosphate, Magnesium (P Mg)	235	205	182
Control	166	105†	158

The addition of magnesium sulphate to the more usual manures has produced no constant nor large increases.

Taking the Magnesium (Mg.) and no Mg. treatments together and expressing controls as 100 we have

	<i>Estate A</i>	<i>Estate B</i>	<i>Serdang</i>
NPK	141	159	113
PK	120	178	150
P	146	212	115
Control	100	100	100

Increases over controls (= 100) which are statistically significant ($P = 0.05$) are

Estate A 22 per cent. B 37 per cent. Serdang 96 per cent. which has the meaning that under the conditions obtaining the chances are 20:1 against values equal to or greater than those given being attained by chance.

* Compiled from Departmental records by W. N. C. Belgrave.

† The "control" plots on Estate B include two limed plots. Liming had no appreciable effect on yield.

It may, therefore, be wagered with some security that on Estate A NPK and P and on Estate B all treatments have largely increased yields, while no certainty can be attained in the case of Serdang (largely owing to the employment of too few replicates — three as against five or six on the two estates).

It is noteworthy that the highest increases have been given by the simplest (and cheapest) fertilisers; potash on these results must be regarded with suspicion. Nothing definite can be said about the effect of the addition of nitrogen as there was no treatment nitrogen-phosphorus.

There remains the possibility that in spite of randomisation of plots an odd chance has decreed that the control plots are all inherently poor. This may be treated by examining preliminary yields taken in 1930, which give (control = 100).

		<i>Estate A</i>	<i>Estate B</i>	<i>Serdang</i>
NPK	...	84	137	87
PK	...	65	139	112
P	...	84	105	104
Control	...	100	100	100

It must be realised that for the first half of 1930 treatments are fictitious. From this it appears that the controls were not conspicuously poor and that in fact the actual increase brought about by manuring was greater in the case of Estate A than appears to be the case, taking one year's results only.

Applying a method known as that of co-variance to the yields of all plots for the two years, 1930 and 1931, it is found for Estate A that the true effect of treatments, when account is taken of the inherent capacities of plots, can be better expressed by

NPK	...	228
PK	...	203
P	...	239
Control	...	100

While it is not claimed that this statistical manipulation gives exact results, it is possible to say with some certainty that the increases found are real, and, in the case of Estate A, actually underestimate true increases.

Financial.

Taking the conventional factors of a yield of 60 per cent. clean fruit from bunches and 25 per cent. oil recovery from clean fruit, it is found that the increases due to phosphate manuring, assuming 55 trees per acre and oil at £20 per ton, are Estate A £4. 9s. per acre and Estate B £7 per acre.

This has been secured by the expenditure of approximately 3 cwt. of super-phosphate costing approximately £1 per acre. The actual return on Estate A has probably been considerably greater.

The soils are quartzite on Estate A and organic on Estate B and are typical of the majority of oil palms soils in Malaya. The palms at Serdang are growing

on a dark valley quartzite underlaid by a hard pan of fine sand, which is not typical.

It is probable that results at least as good, if not better, would have been attained by the use of basic slag instead of superphosphate: while it is reported from Sumatra that good results have followed the use of finely ground natural (rock) phosphate.

For 1932 basic slag instead of superphosphate has been substituted in these experiments, and a further experiment is being laid down on hill quartzite at Serdang to test natural phosphate.

Summary and Conclusions.

Financially satisfactory results have followed application of phosphate manures to 7—8 year old palms growing on hill quartzite and on organic (peaty) soils, and there appears to be no reason to suppose that good results will not follow similar applications elsewhere.

The method of application has been described in the *Malayan Agricultural Journal*, February 1932, page 111.

Addition of magnesium sulphate to phosphate mixtures gave no real increase of yield.

The liming of two plots on organic soil gave no indication of increased yield.

The addition of potash or potash and nitrogen to the phosphatic manure gave no additional increase and there is some evidence that the effect of potash was harmful.

There is no evidence from these experiments as to the effect of nitrogen without potash.

Miscellaneous Article. MYCOLOGICAL NOTES.

BY

A. THOMPSON,

Acting Government Mycologist.

Oil Palms.

Stem-rot.—The species of *Fomes* associated with stem-rot disease of the oil palm has been found during the past year growing on almost every diseased palm examined. The fructification is usually resupinate, and appears when the disease is in an advanced stage. It has not been noticed on palms in an early stage of the disease. The fungus will shortly be named by Mr. E. Corner, Assistant Director of Gardens, Singapore.

Recent inspection of areas where preventive painting of pruned leaf bases was being tried, showed the necessity for treating the small wounds low down in leaf bases as well as treating the sloped, cut surfaces. These wounds are caused in a leaf stalk, when the leaf below it is pruned, and are frequently inconspicuous. In almost every instance, however, if the wounds are opened up it will be found that the leaf base tissue is rotted at this point, although the surface of the sloped cut may appear to be healthy. The type of rot present is more often of the non-penetrating kind, but occasionally a rot resembling stem-rot is found. Consequently, if preventive measures are being adopted, it is useless to paint the cut surface of a leaf base if the wound beneath is not treated in addition.

The fungus mould (*Thielaviopsis* sp.) is always present in wounded leaf and stem tissue. It is also invariably found in the decaying tissue of palms affected with stem-rot, along with the mycelium of the *Fomes* sp. *Thielaviopsis* is the fungus most commonly associated at first with the normal decay of leaf bases of oil palms; later on saprophytic fungi become evident, particularly *Polystictus sanguineus*—a thin orange-red fungus which is associated with a chocolate brown, rather dry type of decay. This fungus is at present considered to be harmless.

Fomes lignosus.—This fungus has already been recorded on oil palms in Malaya, and has been reported as the cause of a collar rot of oil palms in Sumatra. It is the well known parasite of rubber tree roots in this and other countries.

The fructifications vary in size from a couple of inches up to a foot in diameter. They are bracket shaped, woody and about a quarter of an inch thick. The upper surface may be red-brown, orange, or yellowish in colour. The under surface is orange or red-brown in colour and is porous. If the fructification is broken the internal tissue is found to consist of two layers; the upper layer is white and the lower layer is red-brown. This test helps to distinguish *F. lignosus* from other species.

The fungus was recently found growing on two oil palms in Selangor. The fructifications were formed on the old leaf bases at soil level, but the stem tissue had not been affected and the roots appeared normal. The leaf bases were decayed with a light brown, somewhat "corky" type of decay. The mycelium of the fungus was present in the soil near the collar and was growing on the outside of the younger, partly developed roots, but was not found in the tissue of these roots. Some of the more recently formed roots were growing through old fructifications, and were healthy.

It is as yet uncertain whether *F. lignosus* should be considered as a potential parasite of oil palms in Malaya. Inoculations have, so far, yielded no result, and cases of infection have not been under observation for a sufficient period to decide the question.

It would be helpful if any cases of this trouble were reported to this Department, before treatment is given, so that further observations can be made.

If the fructifications of the fungus are normally produced before the mycelium penetrates into the stem tissue, it should not be difficult to discover cases of infection in time to adopt control measures, and also to prevent the trouble from spreading to adjoining palms. In the case of stem-rot disease the fructifications of the *Fomes* sp. are produced, as a rule, when the affected palms are in so advanced a stage of attack that treatment is impracticable.

Tobacco.

Diseases of locally grown tobacco are being investigated.

A leaf disease caused by the fungus *Cercospora nicotianae* is prevalent. The disease is known as "Frog eye" leaf spot, in tobacco growing countries, and tends to reduce the market value of the crop.

"Slime disease" caused by a soil organism (*Bacillus solanacearum*) is also in evidence, on land where several crops of tobacco have been grown without rotation. Plants affected with this disease wilt rather suddenly, and do not recover. On splitting the stem of such plants down to the tap-root a blackish discoloration of the vascular system is exposed and if the stem is cut horizontally the vascular ring is found to be discoloured brownish-black and in a few moments cloudy, yellowish-white sap exudes from the cut surface.

It is reported that the disease is difficult to control if crop rotation, extending over a period of five years, is not practised. The organism is capable of attacking many cultivated plants and weeds, so that the range of rotation crops is limited.

Attempts to control slime disease with soil fungicides have not been very successful up to the present.

Coffee.

A small outbreak of twig die-back occurred recently. The fungus associated with the trouble was *Gloeosporium coffeanum*, a known parasite of coffee leaves, stems and berries. The affected plants recovered without treatment.

A white fungus is often found growing on coffee leaves along with *Hemileia vastatrix* in the same pustules. Pure cultures of this fungus were obtained recently and the fungus was identified, by the Imperial Mycological Institute, as a species of *Myrothecium* probably *M. advena* Sacc.

It is interesting to note that this species was described, in 1908, as occurring on leaves of *Coffea Arabica* in a hothouse at Cherbourg, France.

Tea.

Interesting specimens of Collar-rot of tea seedlings were received. The plants were about eight inches in height, and had begun to die back from the top. It was found that the stems of some of the plants were blackened and the stem sunken in, for about half an inch at soil level. In other plants the stem was ringed at this point exposing the wood. The stem above the ringed portion was swollen and a callus had formed at the edge. Another smaller callus was formed at the edge of the bark below the ring.

This disease has been recorded in Java and India and Ceylon, and has been attributed to overheating of the soil by the sun, followed by excessive humidity and fungus attack, and also to mechanical injury of the stem by soil particles dashed against it during heavy rain.

Abstract.

A NEW METHOD OF PINEAPPLE PROPAGATION.*

The following method of pineapple propagation was worked out by the writer during the latter half of 1929, and up to the present has given excellent results. It promises to supersede the standard method of de-suckering lateral growths for making new material, as it produces a larger number of uniform plants of a given variety within a short time.

The pineapple plant, preferably before the formation of the fruit stem, is stripped of all leaves except the last six or so which form the rosulate young shoot. The rhizome and aerial stem, when freed from roots and scales, is then cut with a sharp knife into clear cross-sections not more than one-fifth inch thick. Such sections, which will carry from three to four, more or less dormant, buds, should be put into a two to five per cent. solution of potassium permanganate for about ten minutes, after which they should be removed and allowed to drain. They are then planted in a flat position on a prepared bed of light soil, or, if a solar frame is available, on a bed composed of chopped coconut fibre and granulated charcoal, covered with a thin layer of soil or fibre, and watered.

Germination of the dormant buds takes place within a week or a fortnight, according to the bed temperature maintained and the pineapple variety. When the buds have formed shoots, the section is lifted (care being taken to retain any embryo root system) and is severed in three triangular portions, each with its own bud. The sections are then re-dipped in the permanganate solution, re-planted in the germinal bed, and watered with a solution of ammonium sulphate. Within a short time the embryo pineapple plants with a good root system, can be transferred to an outside bed or further advanced in the green house in manured beds. Only moderate watering is necessary, but free use should be made of fibrous material (chopped coir) and dressing of cotton-seed meal or similar complete manures. The stem end may also be dipped in permanganate solution and embedded in the chopped fibre, where it roots readily. The permanganate solution is used to prevent the growth of destructive organisms.

The object of using unfruited stems is to take full advantage of the food reserves present, of which each bud is allotted a share in sectioning. Furthermore, the buds being stimulated by moist heat and by flooding with the nutrient solution, can develop a root system before decay sets in. Subsequently, the triangulate scrap of stem is almost completely re-absorbed, leaving behind only the fibrous remains of the vascular bundles intimate with the root system. It should be observed that water and gaseous exchange takes place only with difficulty through a cork membrane, thus the passage of these substances must

* Portion of an article entitled Plant Propagation, by E. A. Walters, F.R.H.S., F.R.M.S. in *Tropical Agriculture*. Vol. IX, No. 2, February 1932

occur mainly through the cortex at the cut ends of the sections, and care should be taken not to bruise these areas when cutting sections for germination.

The development of flower heads in maturing pineapple plants required for propagation may be prevented by a drop of weak sulphuric acid tubed into the centre of the expanding bud.

Subsequent Treatment of Young Plants.

From mature stems of one foot in length, from 80 to 100 plants may be obtained within six months, ready for setting out in nursery beds. Diligent manuring may be practised with the young plants, which respond vigorously to dressings of cotton-seed meal. It is not expected that such plants will behave any differently from the side-shoots and suckers tardily developed in the normal flowering and fruiting plant, or that they will not carry satisfactory fruit characters. Also, in view of the fact that the young buds are isolated from the parent before the pre-fruiting period of dormancy sets in, they should develop into fruit plants equal to, or better than, the parents forms. This is suggested by the behaviour of injured main stems, unable to fruit, but which develop a crowd of suckers each endeavouring to fruit but failing to do so owing to starvation. Most rhizome-bearing plants would appear able to reproduce themselves when treated in this manner: ginger, for instance, produces large numbers of plantlets when buds are isolated and suitably manured. In propagation work of this kind, the main object is to induce the plant or re-direct its energy wholly to the continuous production of meristematic tissue.

As seen very clearly in the Java water-sucker method of cane variety propagation, a normal single-bud shoot or cutting can be made to produce many buds by checking the formation of leading shoots as fast as these develop. This is done by lifting, dividing and replanting the bud-bearing cutting, with the leafy shoots pruned back and covered flat in the propagating bed. This is far quicker than waiting for mature cane cuttings whereon the single bud has become dormant and slow to respond. By this method, important and scarce varieties may be rapidly propagated from one introduced cutting, while the danger of importing large numbers of possibly diseased cuttings is avoided. The writer introduced one cutting of P.O.J. 2878 late in 1928, and this variety is now established at three sugar factories and is still available in quantity. Probably about 500,000 effective plants could now be obtained if all stools were divided and re-planted. This method can be successfully-practised on the sugar estates.

Reviews.

The Coconut.

BY

EDWARD BINGHAM COPELAND.

Third Edition — 1931 — MacMillan & Company. London.

The third edition of this book forms a comprehensive compilation of useful facts concerning the coconut palm, derived from many years of scientific observations in the Philippine Islands and aims at providing information of practical utility for the planter in a readable and concise form.

This aim has been fully achieved. On the grounds of doubtful practical utility, chapters on statistics, capital costs and financial returns in the Philippine Islands have been omitted, though they would have been of interest to planters in other countries. In the opening chapter the physiology of the coconut is indicated in concise and simple language by reference to the general structure of the root and leaf based on many observations by the author and a multitude of students over a period of 27 years. The vital factors affecting the crop are enumerated and discussed and particular stress is laid on the value of sunshine in the economy of the palm, and on the physical condition of the soil in relation to the importance of movement of soil water. The history, distribution, symptoms and remedies of the known pests and diseases are discussed at length, special emphases being laid on bud rot, the rhinoceros beetle and the red weevil as the most important maladies in coconut cultivation. In the chapter on seed selection, the fruits of the chief varieties found in the Philippine Islands are briefly described and compared with similar varieties elsewhere and sound general rules for the selection of seed nuts are adumbrated.

The planting of dwarf types for copra production is deprecated on the grounds of economy in collection and manufacture though no differentiation is made between the different types of dwarf in this respect and though crops from dwarfs are quoted as being in excess of those from ordinary tall types. In an interesting chapter on field culture, the author favours triangular planting so as to make full use of the land, provided that 8 metres is regarded as the minimum distance between palms, though wider than this is generally advisable. He recommends supplying all vacancies which occur in the first 10 years after the original planting with supply palms approximately equal in development to the average of the stand and though this procedure is hardly practicable for palms 10 years old, the principle of filling vacancies with advanced seedlings 3—4 years old, if given special nursery treatment as regards spacing and depth of soil, might usefully be adopted. Catch crops are not favoured, except where they are a necessity and in this case the author considers that tapioca, for starch and alcohol production, is the best economically. In young groves he thinks that cultivation should be limited to small circles surrounding each palm and to

the destruction of any plants likely to overshadow the coconuts; the suppression of 'lalang' is only mentioned in connection with covercrops.

In adult plantations the author rightly maintains that good field practice must vary according to local soil and climatic conditions and according to fluctuations of copra prices and labour wages. The meagreness of reliable data regarding manurial effects is stressed and it is contended that manures are of little use unless the cultural treatment is such as to secure the complete utilization of the fertilizers applied. He believes that nitrogen is best applied in the form of green manures, but wisely advises experimentation on a small scale before any manurial programme is adopted. As regards harvesting the crop the author maintains that nuts should be permitted to ripen fully on the palm until they fall—a practice which has obvious disadvantages on large estates but which would certainly improve the quality of the copra from small holdings.

With reference to the manufacture of copra it is soundly indicated that the best copra can only be produced from fully ripe nuts dried uninterruptedly from the time the nuts are opened until desiccation is complete. The loss of oil due to the presence of black and yellow moulds resulting from insufficient drying of copra is pointed out and several forms of driers in general use in the Philippines are described, but this section is disappointing in comparison with practice on local European managed estates though it justly portrays conditions on small holdings. There is an interesting chapter on the minor products of the palm in which the dwarf palm is recommended as a source for toddy though in this country tappers prefer the tall palms since they produce more liquid per tapping. The book is couched in plain straight-forward language, eminently readable and should be a welcome addition to every planter's book shelf.

H. W. J.

Departmental.

FROM THE DISTRICTS.

The Weather.

Weather conditions varied considerably in different parts of the country during the month. On the western side from Province Wellesley to Malacca, conditions were fairly dry, except for frequent and heavy showers in the country adjoining the main range in Perak and Selangor, with lighter showers in Kedah and the inland Districts of Kelantan and Negri Sembilan. On the eastern side, the plain of Kelantan was dry, while in Pahang showers fell in the second half of the month. In Johore the rainfall varied considerably, being high in places and fairly normal in others, while in Singapore it was well above the average for the month.

Remarks on Crops.

Rubber.—Prices for small-holders' rubber showed little change as compared with those of April, ranging in dollars per picul from 4 to 7.50 for smoked sheet, 3 to 6.25 for unsmoked sheet and 1 to 3.50 for scrap and lump.

The area of untapped small holdings again showed an increase, more especially in places where alternative occupations such as fishing, opening up new land for padi, fruit hawking, or even wood cutting were available. This increase in the number of untapped holdings was most noticeable in Province Wellesley, the Dindings and in the coastal Districts of Selangor. Where tapping was continued it was done on the share system, left to the women and children, or in Perak South was carried out before dawn, so that the men of the family were free to supplement their resources by other work.

Further instances of the cutting out of rubber were noted, especially where the trees were old or unprofitable. This was done to make room for planting food crops and fruit, or in mixed plantations to encourage the growth and yield of fruit trees and coconut palms. In Penang Island reduction of assessment was a further inducement. The trees removed were often sold for firewood at \$1 to \$2 a cart-load.

Padi.—The padi harvest was completed in Kedah where preliminary figures indicate that the crop was the heaviest on record, surpassing even the good crop of the previous season. In Kuantan District of Pahang the harvest was also completed and yields from an extended area were encouraging.

Work on the preparation of the land for the coming season's crop was commenced in north Kedah, in Krian and the central and southern Districts of Perak. In Province Wellesley work commenced was stopped by draught and in Malacca the prolonged draught delayed operations until the end of the month. In Selangor the inter-season crop was transplanted from the nurseries and in other States the fields were in various stages of preparation or transplanting was in progress.

The army worm, *Spodoptera mauritia*, damaged nurseries in Temerloh District, but spare seedlings from the Padi Test Plot were supplied to enable the owners to transplant without loss of time.

In Province Wellesley and central Perak a definite tendency to plant vegetables, where possible, on padi land in fallow was observed.

The indications are that almost everywhere the area planted with padi in the coming season will be considerably extended, both by the utilisation of all padi land formerly uncultivated and by the addition of new areas suitable for this crop.

Distribution of seed of pure strains has taken place to a moderate extent in all States. From Malacca about 3,000 gantangs of Radin Siak were sent to Pekan to replace the nurseries destroyed by the March flood, while 1,161 gantangs of four local pure strains were supplied at 8 cents per gantang, or in exchange for local padi, to Malacca growers for seed purposes.

There has been little change in local padi prices which have ranged between 6 and 8 cents a gantang in the larger padi areas and 7 to 15 cents elsewhere.

Coconuts.—Yields of nuts, which had been low in most districts, improved. In Selangor especially, but also in Penang Island, southern Perak and Johore, the number of Malays who themselves prepare copra is increasing steadily. For this purpose use is being made of the cheap type of efficient kiln recommended by the Department of Agriculture; small groups of Malays work together to supply the nuts and to produce a better quality of copra. This development has been encouraged in parts of Selangor by the enhanced price offered by certain buyers for the better quality product. In the Kukup District of Johore the Malays are not only working together to prepare their copra, but are shipping it direct to Singapore where they obtain a better price than that offered locally.

Increased interest in this cultivation and better care of holdings were recorded. In Selangor and Johore dry padi is extensively grown as a catch crop with immature coconuts, while in Province Wellesley some coconut holdings were interplanted with tapioca, sweet potatoes and chillies.

The local prices of copra have remained fairly steady.

Tobacco.—Interest in this crop is well maintained, although in some areas increased production is causing a fall in price. Good plots of tobacco have been observed in Kelantan, especially on the coastal sandy soils. The planted area in Kedah has been extended and additional shops have been opened for the manufacture of cigars and tobacco. The decline in the planted area in Province Wellesley continued and may be attributed to low prices, difficulty in finding buyers and damage by the stem boring caterpillar. In Perak South, Selangor and western Pahang, weekly fairs provide a useful market for the tobacco prepared by Malays.

Pineapples.—Large supplies of fruit were received at all factories during the month with a consequent drop in prices which, however, are better than those paid during the corresponding period of last year.

Fruit.—In Province Wellesley the first durians ripened. Large quantities

of mangoes were being imported into Penang from Siam and India and were cheaper than locally grown fruit. The mango season in Malacca terminated. On the finer coastal sand of Kelantan the pomegranate grows and fruits successfully; fruits which ripened during the month were sold locally for 20—25 cents each.

Mushrooms.—A Chinese in Penang Island is successfully cultivating mushrooms. They are sold for 30 cents per kati fresh and \$2.00 per kati dried.

Pigs.—The pure bred pigs sent to Sungei Buloh, Selangor, from the Government Experimental Plantation, Serdang, in 1930 have been very successful in that locality and there is a big demand for their off-spring. The cross between the local sow and the pure bred boar is stated to be a hardier and more quickly maturing animal than the pure bred pig. The Middle White is preferred to the Large Black breed owing to its colour. A number of pig breeders in this area have now dispensed with all their local pigs and have substituted crossbred animals.

Rat Control in Padi Fields.

Organised hunts were continued on Glugor Estate, Penang, but attempts to persuade Malay padi landowners to follow this example were not very successful. In the Province distribution of poison baits was continued. In Krian work on the usual lines was successfully maintained; in addition a lecture tour in conjunction with the Medical and Health Department was undertaken. At each centre a short talk on padi management by an officer of the Department of Agriculture was followed by a lecture on rats delivered by a member of the Medical and Health Department. The importance of this pest in relation to health and agriculture was stressed and control measures were demonstrated by the rat destruction officers. Fifteen centres were visited and the attendance was satisfactory. In Malacca rewards were paid for 73,268 tails at the rate of four tails for one cent.

Agricultural Stations and Padi Test Plots.

KELANTAN. Kota Bahru Padi Experiment Station.—At this new station water supplied by an electric motor and pump enabled ploughing to be commenced at a time when the land would otherwise have been too hard. Trials made at the Station showed that the local plough was superior to an imported single-handled plough designed to meet Eastern requirements. Seed of nine locally popular varieties of dry padi was collected for planting.

PROVINCE WELLESLEY AND PENANG. Bukit Merah Padi Test Station.—The area of $\frac{1}{4}$ acre, devoted to demonstrating the possibility of growing other short-season crops in the interval between padi crops, was planted with six varieties of vegetables. Local Malays were evincing an interest in this demonstration.

The planting of the various crops at the newer Agricultural Stations has

progressed well, while on Padi Stations and Test Plots work has been undertaken in accordance with the normal planting programme of the area in which each is situated, except that at the Glugor Station in Penang and the Kajang Test Plot in Selangor inter-season crops of padi have been planted and are growing satisfactorily.

Weekly Fairs.

Weekly village fairs, which have proved successful in several parts of the Federated Malay States, have recently been organised at ten convenient centres in Kedah by a Committee of which the Assistant Principal Agricultural Officer is Chairman. Fairs at two other centres are being arranged. Their object is to provide opportunities for the Malays to sell at reasonable prices, or to barter, their rice, vegetables, meat, fish, poultry, fruit, tobacco or other produce and thus to encourage and extend the planting of foodstuffs and fruit and the rearing of animals and poultry. A similar fair has recently been started in Kampong Bahru, Kuala Lumpur. These fairs can materially assist in adjusting supply and demand in different parts of the country. As an illustration of this point it may be mentioned that lorry loads of coconuts grown outside the State are sold at some of the fairs in the Kuala Pilah District of Negri Sembilan, while tobacco produced by Malays and Javanese in distant parts of Selangor found a ready market at the first and second fairs in Kampong Bahru, Kuala Lumpur.

DEPARTMENTAL NOTES.

Visits of the Director of Agriculture.

The Director addressed the Kuala Lumpur Rotary Club on rice cultivation in Italy on April 29th.

On May 1st and 2nd he inspected the Dairy Farm at Fraser's Hill.

On May 5th he attended a meeting of the planters at Sungkai which was addressed by Col. Eaton. At this meeting a rubber film was exhibited. The Director also addressed the meeting on the subject of work on new uses for rubber in the F.M.S.

On May 6th the Director inspected the area affected by the rubber pests on Narborough Estate in company with the Visiting Agent and Manager. On the same day he proceeded to Kuala Kangsar and there inspected the Agricultural Station, the Padi Experiment Station at Talang and subsequently proceeded to Kenas and walked over the irrigation area with the Senior Agricultural Officer, Perak.

On May 7th, after an interview with the District Officer, Kuala Kangsar, he inspected with the Senior Agricultural Officer, the padi experimental plots at Bukit Gantang and then proceeded to Taiping where he inspected the Kamunting Experiment Station and dealt with other matters. In the afternoon he proceeded to Selama and inspected the new Agricultural Station. After leaving Selama he proceeded to Krian and inspected sites for the proposed test plots in the Krian area. He returned to Kuala Lumpur from Taiping by the night mail.

On Friday May 29th, the Director proceeded to Singapore to attend a meeting. He returned to Kuala Lumpur on the following day, and in the afternoon proceeded to Teluk Anson where he attended a meeting of the coconut planters on Sunday in conjunction with Mr. F. C. Cooke as a preliminary to the latter's tour in the Bagan Datoh District. The meeting was addressed by Mr. Cooke and the Director on the subject of copra research work.

Demonstrations to Chinese.

The value of demonstrations to Chinese agriculturists was strikingly illustrated as a result of the application by a number of Chinese in the Bukit Kapar Chinese area in Selangor for permission to continue the inter-planting of rubber in their coffee plantations, as they stated that the soil was unsuitable for coffee cultivation.

Inspection of the area shewed that the coffee had been severely attacked by leaf-eating caterpillars in 1930 and as a result of excessive soil wash and poor cultivation, many of the trees had failed to recover.

Methods of soil conservation were explained to the headmen by the Chinese Sub-Inspector of Agriculture, but they stated that they were too expensive, of little use and that they still wished to plant rubber, as it was the only crop which paid.

In consequence of this unwillingness to carry out necessary cultural operations, a party of seven of the Chinese headmen visited the Government Experimental Plantation, Serdang, and the Chinese Tea Area at Sungei Balak on April 30th, to inspect the cultivation of crops and the methods of soil conservation. The party was particularly impressed by the tea area at Sungei Balak, the Chinese headman of which enthusiastically explained to them tea cultivation and especially the benefits to his own crops which followed the introduction of silt pits and cover crops.

The party was then taken to the Cheras Experimental Station, where they saw further methods of soil cultivation and a number of crops.

The headmen finally agreed to call a meeting of their friends at which they would advise the cutting out of the interplanted rubber and the further planting of coffee, tobacco and other crops together with the introduction of silt pits and cover crops.

Lectures in Lower Perak.

During the period, May 22nd to May 28th, the Assistant Chemist for Copra Research visited twenty coconut estates in the Bagan Datoh district of Lower Perak and certain native small-holdings at Sabak Bernam. The object of the visits was to indicate faults in manufacturing methods and in kiln design and to make suggestions which would lead to the export of an improved grade of copra from this District. It may safely be claimed that these suggestions involve no increase in the actual cost of manufacture though a number of alterations to existing kilns are essential.

On 22nd May an address was given to the members of the Coconut Planters' Association at the Bagan Datoh Club entitled "The Deterioration of Copra". Amongst those present was the Director of Agriculture, Straits Settlements and Federated Malay States, who contributed to the subsequent discussion which was of a most interesting and animated character.

On May 26th a further lecture was delivered to a well-attended meeting of the Association, entitled "Copra Manufacture".

School of Agriculture, Malaya.

The School of Agriculture reopened on 17th May 1932, and has thus been launched on its second year of existence. There are now 29 students in residence as against 37 at the end of the past school year, 24 students having left in April on the conclusion of their training, while 16 new students have been admitted.

Unfortunately for the school, the recruitment of Agricultural Students and Pupils in Training for the Federated Malay States and Straits Settlements Governments has had to be suspended temporarily, owing to the financial situation. Had this recruitment been possible, a further 22 students would probably have entered the school this term.

Of those now in residence, 24 are taking the Three Years Course, and 5 the One Year Course of training. 17 are Malays, 4 Chinese, and 8 Indians.

In relation to new students, two significant features are to be observed. In the first place, considerable progress has been made in the provision of scholarships, the Jaffnese Co-operative Society Ltd. having awarded four, the Victoria Institution two, and the Sarawak Government one scholarship—all tenable for the Three Years Course. In the second place, the fact that there are two boys from Brunei, one from British North Borneo and one from Sarawak is evidence that the school is appreciated beyond the Peninsula itself.

Tea Machinery at Cameron Highlands.

The installation of the machinery in the new tea factory at the Experimental Station, Cameron Highlands was completed by the F.M.S. Government Factory in April.

A trial run of the machinery was made in the presence of the Director of Agriculture on 14th April, when it was found necessary to make minor adjustments in the speeds of the machinery, which faults have now been corrected

Statistical.

MARKET PRICES.

May, 1932.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 5.39 cents per lb. in Singapore, 3.04 cents (gold) New York and 1.81d. London in May, as compared with 5.4 cents Singapore, 1.46 cents (gold) New York and 2.97d. London in April. The highest Singapore price recorded in May was 5½ cents per lb. and the lowest 5 cents per lb.

Palm Oil.—The course of the market during May was as follows:—6th. £15.10.0., 13th. £14.10.0., 18th. £15.10.0., 26th. £15. These prices are c.i.f. Liverpool on a basis of 18 per cent. f.f.a. The market was reported to be steady.

Copra.—Prices have shewn a downward tendency during the month. The average price of Sundried was \$5.48 per picul as compared with \$5.67 in April. Mixed averaged \$4.92 per picul as compared with \$5.06 in the previous month.

Copra cake averaged \$1.82 per picul in May.

Gambier.—Prices have been quoted between \$16 and \$17 per picul throughout the month for Cube No. 1, the average price being \$16.62 as compared with an average of \$17.50 in April. The average price of Block gambier in May was \$7.69 per picul as compared with \$8.37 in April.

Rice.—The following are the wholesale prices of rice per picul in Singapore in April:—Siam No. 2 ordinary \$3.84, Saigon No. 1, \$4.01, Rangoon No. 1 \$3.89. Corresponding prices in March were \$4.26, \$4.24 and \$4.12.

Retail prices in cents per gantang of Siam No. 2 rice in April were:—Singapore 31, Penang 38, Malacca 30 as compared with 32, 38 and 30 respectively in March.

Coffee.—Prices improved during May. The average Singapore price of Palambang coffee in May was \$18.54 per picul as compared with \$15.65 in April. Average prices for Sourabaya coffee were from \$21.75 to \$23.19, the price within these limits depending upon quality. The corresponding prices in April were from \$19.95 to \$21.25.

Arccanuts.—Singapore prices have sagged still further. Palambangs averaged \$2.75 per picul in May as compared with \$3.24 in April and Bila Whole \$2.87 as compared with \$3.32 for the previous month. Average May quotations for other grades were as follows:—Split \$3.50 to \$5.16, Red Whole \$5.25 to \$6.12, Slice \$9.19 to \$10.81. Kelantan \$4.50 to \$4.96, the price within each range depending upon quality.

Pineapples.—Canners have held for a minimum price at which the London market is only buying sparingly. Quotations for May have therefore been steady at \$3.50 per case for 1½ lb. cubes, \$3.30 per case for ½ lb. sliced flat, and \$3.50 per case for 1½ lb. sliced tall. Corresponding average prices for April

were \$3.47½, \$3.30, and \$3.52½.

Tapioca.—Flake fair has improved slightly, the closing price being \$3.25 per picul, while the average for May was \$2.75 as compared with \$2.81 in April. Pearl seed has been steady throughout the month at \$3.80 as compared with an average in April of \$3.85, while Pearl medium has been quoted throughout May at \$4.25 as compared with \$4.21 in April.

Sago.—Prices for Pearl, small fair, have been steady at \$4.25 per picul as compared with \$4.17½ in April. Flour, Sarawak fair, averaged \$2.04 per picul the demand having fallen off during the month. The average price of this grade in April was \$2.17½ per picul.

Nutmegs and Mace.—Prices nominally shew little change, but sellers are reported to be keen to secure business. Average price of nutmegs in May were:—110 per lb. \$24 per picul as compared with \$25.37½ in April; 80 per lb. \$27.25 as compared with \$28.87½ in April. Mace prices throughout the month were quoted as follows:—Siouw \$61 per picul, Amboina \$44 per picul as compared with \$68.75 and \$45 per picul respectively in the previous month.

Pepper.—Demand has been small and prices have eased somewhat. Average prices per picul for May were:—Singapore black \$18.56, Singapore white \$22.25, Muntok white \$22.75. Corresponding prices in April were \$20.25, \$24.25, and \$24.75.

Cloves.—Nominal prices quoted remain unchanged at \$47 per picul for Zanzibar and \$50 for Amboina.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Weekly Reports published in May. Palm oil reports are kindly supplied by Messrs. Cumberbatch and Co., Ltd., Kuala Lumpur, and reports on the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY. *

April, 1932.

Malaya.—Gross foreign imports of rice during April 1932 amounted to 38,275 tons as compared with 47,188 tons in April 1931, of which 46.6 per cent. were consigned to Singapore, 13.1 per cent. to Penang, 6.4 per cent. to Malacca, 13.1 per cent. to F.M.S. and 2.8 per cent. to the U.M.S.

Of these imports 63.8 per cent. were from Siam, 34.1 per cent. from Burma, 1.1 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice in April 1932 were 12,821 tons (including 111 ton domestic production exported from Penang) as compared with 12,445 tons in April 1931. Of these exports 78 per cent. went to the Netherlands East Indies and 22 per cent. to other countries.

Net imports for the period January to April 1932 were 139,539 tons as compared with 175,872 tons for the same period of 1931, a fall of 20.7 per cent.

Padi reports state that the harvest is completed in the chief padi-growing districts in the Federated Malay States and in Malacca, while it is in progress in Province Wellesley and Kedah. Crops generally are stated to be good.

India.—Total foreign exports of rice (*Indian Trade Journal* 28.4.32) during February 1932 were 241,000 tons as compared with 168,000 tons in January 1932 and 146,000 tons in February 1931, increases of 43.5 per cent. in respect of the previous month and 65.1 per cent. in respect of the same period of the previous year.

Total exports of rice and bran from Burma for the period January 1 to March 26, 1932, amounted to 1,004,397 tons as compared with 902,707 tons for the same period of the previous year or an increase of 11.3 per cent.

Of the above exports 255,996 tons went to India in 1932 as compared with 382,562 tons in 1931, a decrease of 33.1 per cent.

Siam.—Exports of rice from Bangkok during March 1932 amounted to 155,689 tons (approximate) as compared with 121,931 tons in March, or an increase of 27.7 per cent.

Exports of rice from Bangkok during the period December 1931 to March 1932 amounted to 495,886 tons an increase of 88,673 tons or 21.8 per cent. as compared with the same period of 1930—1931.

Netherlands India.—*Java and Madura.* The *Korte Berichten* states that at the end of March 1932 the area harvested amounted to 1,288,000 acres, an increase of 169,750 acres or 15.2 per cent. as compared with the same period of 1931, the area damaged to 37,145 acres a decrease of 9,419 acres or 20.2 per cent. as compared with 1931, and additional plantings awaiting harvest to 6,742,750 acres an increase of 1,750 acres as compared with 1931, a total of 8,067,895 acres as compared with 7,905,810 acres for the same period of 1931, an increase of 2 per cent.

* The following is abridged from the Rice Summary for April 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Imports of rice into Java and Madura during the first quarter of 1932 were 77,779 tons as compared with 100,059 tons for the same period of 1931 or a fall of 22.3 per cent.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 30.4.32 amounted to 445,412 (metric) tons, an increase of 64,677 tons or 17 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 30.4.32 amounted to 410,199 (metric) tons an increase of 88,431 tons or 27.5 per cent. as compared with the same period of 1931.

The *International Crop Report*, Rome, for March 1932 states that the crop of the tenth month (1,203,400 tons of rough rice) in Tonkin was below expectations being 91.8 per cent. of last year's especially large crop and 19.3 per cent. above the average of the five years ending 1929—30. Though production data for the crop of the second semester in Annam and for the crop of Cochin China, and Cambodia, which together make up over half the total for Indo-China, are lacking, it may be stated from the general information available that the total crop of Indo-China will be 200,000 tons to 290,000 tons below that of the preceding season and 400,000 tons to 490,000 tons below the five year average; this year's crop will thus be one of the smallest in the last decade.

The padi market in April (Official Report) was firm at the beginning of the fortnight, became slightly easier and closed on a quiet note. Cholon possessed fairly large stocks of padi and farmers living in the provinces were chary of putting their stocks on the market.

In the rice market (Official Report) Japan made enquiries during the first half of April and when this ceased the market weakened as neither Hongkong, Shanghai nor Java evinced any interest. France bought some small parcels.

The Broken's market (Official Report) during April was very quiet though India purchased a few small lots. In spite of the poor demand the market remained very firm.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe, period January 1 to April 14, 1932, 265,401 tons as compared with 204,718 tons for the same period of 1931, or an increase of 29.6 per cent.

Of the 1932 shipments 64.5 per cent. was from Burma, Nil from Japan, 27.5 per cent. from Saigon, 2.2 per cent. from Siam and 5.8 per cent. from Bengal as compared with 61.4 per cent. from Burma, 4.6 per cent. from Japan, 20.0 per cent. from Saigon, 8.5 per cent. from Siam and 5.5 per cent. from Bengal in 1931.

- (b) To the Levant, period January 1 to March 10, 1932, 22,361 tons, an increase of 14,109 tons or 171 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January to March 8, 1932, 32,670 tons, a decrease of 4,758 tons or 12.7 per cent. as compared with the same period of 1931.

MALAYAN AGRICULTURAL EXPORTS, MARCH, 1932.

PRODUCT.	NET EXPORTS IN TONS.				
	Year 1931	Jan.—Mar. 1931	Jan.—Mar. 1932	March 1931	March 1932
Arecanuts ...	19,266	5,522	7,108	1,649	2,668
Coconuts, Fresh ...	10,468	1,685	22,977*	478	9,760*
Coconut oil ...	9,909	2,361	2,642	920	931
Copra ...	100,809	19,975	18,643	5,768	5,590
Gambier all kinds ...	2,563	595	829	212	326
Palm kernels ...	726	117	265	60	95
Palm oil ...	4,574	803	1,444	295	623
Pineapple, canned ...	59,457	13,077	16,374	3,039	4,438
Sago — flour ...	5,608	478	3,762	1,054	734
Sago — pearl ...	2,429	340	642	147	191
Sago — raw ...	2,904†	1,009†	1,049†	313†	471†
Tapioca — flake ...	9,742	2,825	2,178	1,115	852
Tapioca — flour ...	491†	178	95†	169	78†
Tapioca — pearl ...	19,006	4,052	4,672	1,555	2,076
Tuba roots ...	74	15	30	5	28

* '000 in number.

† Net imports.

Correction.

Area of land in Malaya planted with rubber at end of 1931.

Reference the table on page 247 of May 1932 number of this Journal, the figures for Johore should read as follows:—

		Estates of 100 acres and over.			Estates under 100 acres Total	Total area planted
		Tappable.	Immature.	Total.		
		Acres.	Acres.	Acres.	Acres.	Acres.
Johore	...	313,385	145,757	459,142	341,613	800,755.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF MARCH, 1932.

STATE OR TERRITORY (1)	Acreage of Tappable Rubber end 1931 (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5) (7)	Percentage of (7) to (2) (8)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
Perak	238,420	7,808	3.3	28,391	11.9	36,199	15.1
Selangor	294,030	13,174	4.5	36,777	12.5	49,951	17.0
Negri Sembilan	217,002	12,139	5.6	26,404	12.2	38,543	17.7
Pahang	35,122	3,004	8.5	4,474	12.7	7,478	21.3
Total F.M.S.	784,574	36,115	4.6	96,046	12.2	132,161	16.8
Malacca	110,288	4,405	4.0	19,345	17.5	23,750	21.5
Province Wellesley	44,055	4,044	9.2	8,669	19.7	12,713	28.9
Dindings	6,700	431	6.4	1,077	16.0	1,508	22.5
Penang Island	1,585	1,058	66.7	84	5.3	1,142	72.0
Singapore Island	28,033	9,553	34.0	5,942	21.2	15,495	55.3
Total S.S.	190,661	19,491	10.2	35,117	18.4	54,608	28.6
Johore	313,385	28,677	9.2	40,767	13.0	69,444	22.2
Kedah (a)	102,220	5,209	5.1	9,161	9.0	14,370	14.1
Kelantan	16,785	6,742	40.2	796	4.7	7,538	44.9
Trengganu (b)	4,300	Nil	Nil	Nil	Nil	Nil	Nil
Perlis	624	308	49.4	156	25.0	464	74.4
Total U.M.S.	437,314	40,936	9.4	50,880	11.7	91,816	21.0
Total MALAYA	1,412,549	96,542	6.8	182,043	12.9	278,585	19.7

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.
(b) Registered Companies only.

2. Areas rested due to rotational system end March (not included above) : Acres F.M.S. 46,731, S.S. 15,587, U.M.S. 50,331 or 8 per cent. of tappable area (col. 2). Compiled from statistics prepared by the Statistics Dept. S.S. & F.M.S.

MALAYA RUBBER STATISTICS
TABLE I
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVELEX,
FOR THE MONTH OF APRIL, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of 100 acres and over		Production by Estates of less than 100 acres and over		Imports				Exports including re-exports				Stocks at end of month	
	Ports	Dealers	Estates of 100 acres and over	Estates of less than 100 acres	during the year 1932	during the year 1932	during the year 1932	during the year 1932	during the year 1932		during the year 1932		during the year 1932		Ports	Dealers		
					Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
MALAY STATES:—																		
Federated Malay States																		
States	19,432	12,524	11,132	47,123	6,154	30,077	Nil	Nil	Nil	Nil	Nil	11,868	5,848	51,155	24,682	18,696	12,812	
Johore	2,437	3,561	3,561	14,672	3,048	13,645	Nil	4	Nil	18	18	883	6,725	3,711	24,480	2,537	3,450	
Kedah	429	2,202	2,146	8,940	560	3,439	Nil	Nil	Nil	Nil	Nil	590	2,153	2,500	9,892	504	2,090	
Perlis	33	11	7	26	12	35	Nil	7	Nil	Nil	Nil	7	Nil	7	49	36	10	
Kelantan	112	124	119	509	12	1,065	12	Nil	84	Nil	84	47	176	193	1,521	49	107	
Trengganu	55	50	101	385	51	192	Nil	Nil	Nil	Nil	Nil	152	Nil	577		55	50	
Total Malay States	22,496	18,472	17,066	17,655	9,827	48,453	12	4	84	18	18	13,388	14,066	57,559	61,201	21,912	18,499	
SETTLEMENTS																		
Malacca	4,565	1,335	1,252	5,384	(2)	(2)	Nil	Nil	Nil	Nil	Nil	3,498		15,354		4,433	1,332	
Province Wellesley	78	704	421	1,553	(2)	(2)	Nil	Nil	Nil	Nil	Nil	4,981		22,753		86	562	
Dindings	275	89	88	390	1,769	7,543	Nil	14,066	2,354	61,295	61,295	Nil				281	87	
Penang	1,150	4,600	11	1	12		2,633	3,429	21,178	2,354	2,354	14,803				1,179	3,946	
Singapore	2,365	38,039	220	140	636		3,429	3,692	23,512	61,295	23,282	Nil				3,055	35,323	
Total Settlements	3,515	47,557	2,359	1,902	7,975	1,769	7,543	3,692	14,066	23,512	61,295	23,282	Nil	103,660	Nil	4,234	44,069	
TOTAL MALAYA																		
	35,151	70,055	20,831	18,968	79,630	11,569	55,996	3,704	14,070	23,596	61,313	86,670	14,061	16,219	61,201	42,34	65,981	
																	20,730	

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federated Malay States	S'pore	Penang	W. aly	Poor-ince	Johore	Total
20	21	22	23	24	25	26	
DRY RUBBER	16,119	32,689	8,027	4,601	1,158	68,194	
WET RUBBER	2,576	2,684	319	199	1,415	7,148	
TOTAL	18,696	35,323	8,946	4,800	2,573	65,337	

TABLE III
FOREIGN EXPORTS

PORTS	during the year 1932
Singapore	28,773 98 598
Penang	8,290 87,881
Port Swettenham	4,453 21,017
Malacca	154 3,723
MALAYA	36,670 156,219

TABLE IV
DOMESTIC EXPORTS

AREA	For the year 1932
Malay States	82,161
Straits Settlements	135,344
MALAYA	32,161 135,344

Notes:— 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. r. c. Column [7] = Column [13] + [14] + [17] + [18] + [19] + [19A] - [2] - [8] - [4] - [5] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, r. c. 40%; stock elsewhere are in dry weight as reported by the dealers themselves.

4. Double items are included in the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign imports of the earlier month.

5. The above, with certain omissions, is the Report published by W. R. Boyd, M. C. S., Assistant-General of Statistics, S.S. and F.M.S., at Singapore, on 2nd April, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT										EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE			
	Means of			Absolute Extremes				At 1 foot	At 4 feet	Total		Moist in a day		Number of days				Total	Daily Mean	Per cent		
	A. Max.	B. Min.	Mean of A and B	Highest	Max.	Lowest	Min.							Highest	Precipitation .01 in or more	Thunder storm	Fog morning or afternoon				Gale force 8 or more	
				°F	°F	°F	°F	°F	°F	in.	mm.	in.	°F	hr.				hr.	%			
Railway Hill, Kuala Lumpur, Selangor	91.4	72.6	82.0	95	70	84	75	84.7	84.8	°F	84.7	84.8	8.46	214.9	2.59	16	14	5	3	202.90	6.76	55
Bukit Jeram, Selangor	88.6	73.1	80.9	92	70	84	76	84.7	86.2	°F	84.7	86.2	6.69	169.9	1.48	15	14	1		216.90	7.23	59
Sitiawan, Perak	89.7	73.3	81.5	92	70	86	76	84.4	84.6	°F	84.4	84.6	4.63	117.6	1.31	21	18	10	2	212.50	7.08	58
Kroh, Perak	88.1	70.3	79.2	91	66	85	73	83.2	82.7	°F	83.2	82.7	5.64	143.3	1.33	19	15			210.25	7.01	57
Temerloh, Pahang	88.8	73.1	80.9	92	71	78	76	84.7	84.6	°F	84.7	84.6	9.22	234.2	2.17	18	16	5	8	186.15	6.21	59
Kuala Lipis, Pahang	89.0	72.2	80.6	93	70	81	75	84.1	83.7	°F	84.1	83.7	7.47	189.7	1.44	20	18	5	18	182.80	6.09	50
Kuala Pahang, Pahang	86.0	74.3	80.1	89	72	78	79	83.3	84.2	°F	83.3	84.2	20.41	518.4	5.17	21	16	1	1	226.25	7.54	62
Mount Faber, Singapore	87.4	74.1	80.7	92	71	77	77	81.9	82.3	°F	81.9	82.3	6.37	161.8	1.38	17	16	8	3	166.90	5.56	45
Butterworth, Province Wellesley	88.1	74.5	81.3	91	72	83	77	85.0	85.1	°F	85.0	85.1	14.43	366.5	2.73	21	19			225.25	7.51	61
Bukit China, Malacca	86.3	74.0	80.1	90	71	83	76	83.8	84.0	°F	83.8	84.0	5.20	132.1	1.74	13	11	1		210.60	7.02	57
Kluang, Johore	89.8	72.4	81.1	93	70	83	75	82.7	82.5	°F	82.7	82.5	7.31	185.7	1.01	19	18	8	13	175.20	5.84	48
Bukit Lalang, Mersing, Johore	86.6	72.8	79.7	89	70	83	75	82.4	81.4	°F	82.4	81.4	7.21	183.1	1.66	13	12	2		202.50	6.75	55
Alor Star, Kedah	90.5	73.9	82.2	95	69	86	77	86.5	85.9	°F	86.5	85.9	9.10	231.1	2.66	16	13	11	2	244.30	8.14	67
Kota Bharu, Kelantan	89.8	73.6	81.7	92	71	86	76	84.3	83.9	°F	84.3	83.9	1.66	42.2	0.96	9	5	1	2	257.95	8.60	70
Kuala Trengganu, Trengganu	88.8	73.3	81.1	92	71	82	75	84.1	83.9	°F	84.1	83.9	1.60	40.7	0.63	8	7	2	1	254.80	8.49	70
HILL STATIONS.																						
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.9	59.5	65.7	76	56	67	62			°F			12.91	327.9	3.25	21	17	4		138.15	4.61	38
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	72.8	58.0	65.4	76	51	69	64	69.8	69.1	°F	69.8	69.1	13.21	325.5	3.26	21	18	6	5	118.10	3.94	32
Fraser's Hill, Pahang 4268 ft.	73.1	62.9	68.0	78	60	68	65	71.6	71.5	°F	71.6	71.5	14.05	356.9	3.22	23	21	3	19	136.60	4.55	37

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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Coconut & Oil Palm Research Committee.

The Publicity Committee.

THE Malayan Agricultural Journal.

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EDITORIAL.

The Malayan Coconut Industry.

In the present number we wish to emphasise the growing importance to Malaya of our coconut products. This importance is not being attained by any large increase in areas under the crop, but by comparison with certain other major crops, the prices of which have of late declined to an uneconomic level.

It is true that the prices of both copra and coconut oil have dropped to an alarming degree. In view, however, of the many desirable qualities of coconut oil both for edible and soap-making purposes, and to the fact that the world's exportable supplies do not tend materially to increase, the future prospects of the copra industry may be held to compare favourably with most other agricultural products.

We have frequently drawn attention to the premium which Ceylon copra invariably obtains over the Malayan product. During the past two years, several articles have been published in this Journal dealing with various aspects of this problem and including recommendations which, if put into practice by producers, would result in an improved quality of copra.

Recently we have published a Bulletin written by the officer engaged on copra research, which embodies the investigations on the nature of the differences between Ceylon and Malayan copra and which offers numerous suggestions, the acceptance of which by producers would undoubtedly result in an improvement in quality.

The main criticism of this work has been that even if the quality of Malayan copra be improved, price discrimination will not necessarily follow. There is much to be said for this argument, for it is known that buyers in Europe have established standards of quality for copra of different origin.

Furthermore, Ceylon enjoys her pre-eminent position by reason of the fact that the buyer has been accustomed for many years to look to this source for the highest quality copra.

Now, the market for the finest quality copra is said to be limited and the Trade informed us some three years ago that if Malaya produced copra equal to the Ceylon product, the result would not be that our product would command

the Ceylon premium, but by reason of the extra supplies available, the Ceylon price would approximate to the price of the Malayan standard.

This was depressing information, but such that it could not be ignored. Our continued efforts to improve the quality of Malayan copra were therefore founded on the hope that if the market still further declined, dealers would eventually disregard the lowest quality and that Malaya must at least maintain her position in such an event by maintaining or even improving the quality of her supplies.

The signs for the future, however, are more hopeful than at one time we had dared to anticipate. Messrs. Frank Fehr and Company, in their review of the oil markets in 1931, of which we have made liberal use in the review of the industry which appears on another page, point to the diversion of Ceylon copra to India and state that unless the Indian production increases, this diversion of Ceylon supplies to India is likely to be a permanent feature.

This possibility opens up a new aspect for Malayan copra, and is therefore worthy of closer examination. We have to ask ourselves whether the Indian demand for Ceylon copra is likely to be permanent and if so, what effect this will have on the Malayan product.

We have no direct evidence concerning the possible increase in coconut areas in India, but there is certainly evidence that India during the past 15 years has found it increasingly difficult to maintain her independence of outside sources of supply. At one time Malabar copra was superior even to that of Ceylon. Her exportable surplus between 1909 and 1916 was about 28,000 tons per annum. Since then the exports of Malabar copra have declined rapidly and for the past four years have entirely ceased.

For a country which held the premier position in an industry to cease to supply the product is an interesting fact. It rather points to the possibility that India's teeming millions will eventually absorb the Ceylon supply, in consequence of which the rest of the world will have to turn to another source for her supply of first quality copra.

In this eventuality, we can see no reason why the improved Malayan copra should not replace the Ceylon product on the world's market.

Experiments on Copra Production.

The need of assisting the small-holder in obtaining a fair market price for his produce was never more urgent than at the present time, as he has experienced a very severe shrinkage of his income and is not always in a position to turn to new means of gaining a livelihood.

A preliminary enquiry into the conditions of marketing native produce has shown that, as a rule, the small-holder receives a fair price for his produce in the form and condition in which it is marketed and in view of financial arrangements between the producer and the middleman.

It follows, therefore, that short of direct interference in open trade, the most promising form of assistance is of such a nature as to help the producer

to improve his own position. It is on these lines that during the past two years the Department of Agriculture has worked in relation to copra production on small holdings.

In this work, two points have had to be kept constantly in the foreground : firstly, the suggested improvements must be of an inexpensive nature so that they may be within the means of the producer ; and secondly, careful instruction is necessary, especially in the initial stages, in the preparation of copra on the improved kilns.

Native producers are rather apt to look upon the kiln as an achievement in itself rather than as a means to an end. This is borne out by Messrs. Cooke and Simpson in an article on the subject of their efforts to improve copra production by the Malay small-holder. They state that the result of the successful operation of a limited number of kilns was an increase in six months from 6 to 120 small kilns in the sub-district in which the authors were working. It is not claimed, however, that all these Malay producers are manufacturing good dry copra. It is evident that more effective supervision should be given to these small-holders, not only during the erection of the new kilns, but more especially in the early stages of operation.

The Department proposes to give the very widest publicity amongst Malays to these improved methods of drying and marketing copra. This will be effected by the publication in the Malay language of the information contained in the article on copra production and the free distribution of the Malay circulars in suitable districts. Furthermore, officers of the Field Branch of the Department will be requested to give this subject their close attention in coconut areas owned by Malays so that the published information on this subject, supplemented by careful instruction, may result in no waste of effort—the frequent outcome of a wave of enthusiasm—nor failure by reason of the lack of appreciation of all the factors which need consideration, not only on the preparation of improved copra but on satisfactory marketing methods.

Copra Deterioration.

An article by F. R. Passmore, published in the Bulletin of the Imperial Institute, provides a valuable link between the work which is being conducted in Malaya on the causes and nature of copra deterioration by moulds and insects and the effect thereof on the copra as judged by manufacturers and shippers whose opinions are reflected in price discriminations.

The article by Messrs. Ward and Cooke included in this number sets out the attitude of the manufacturers as established by Passmore, and shews the conditions favourable for the incidence of insects and moulds and the methods by which the undesirable characteristics resulting from their attacks may be avoided.

We would observe that although little financial advantage is likely to result from spasmodic or isolated attempts to improve the quality of copra exported

from Malaya, yet concerted action by copra producers to market a better article is likely to attract buyers and lead to a general preference for Malayan copra and ultimately to a price discrimination in our favour.

Food Requirements of Coconuts.

We have previously pointed out in these pages that an indication of manuring requirements. It may easily occur, analysis of the plant foods removed by a crop is no sure for instance, that a plant food which is found in the crop in relatively small quantities is the one which the plant finds most difficulty in assimilating and which therefore proves the limiting factor of development of the plant. The application of such a plant food in an available form may, therefore, have a very marked effect on the crop, in spite of the fact that the element is already present in the soil in considerable quantities though possibly it is largely unavailable for the particular plant.

Admitting these limitations to the study of plant nutrients removed by the coconut tree, as discussed by Messrs. Georgi and Gunn Lay Teik in this number, the results at which they arrive indicate that even supposing that the plant foods contained in the leaves and inflorescences are all returned to the soil, the plant foods in the nuts which are permanently removed from the estate represent a loss which, unless rectified by manuring, may be expected ultimately to have an adverse effect on the health and yield of the plantation.

The period which must elapse before the adverse effect begins to be marked naturally varies with the initial richness of the soil and there is no evidence that it is not being approached on the majority of the coconut estates on coastal soils in Malaya.

The results of these analyses also shew the very great manurial value of leaves and inflorescences and the advisability, therefore, of ensuring the efficient disposal of this material so that the plant foods they contain may again be at the disposal of the palms.

Information on Pests.

In order that planters may be on the lookout for pests, which, perhaps only seasonally, are found to cause damage to crops, and particularly with the object of giving wide publicity to the methods of combatting such pests, Mr. G. H. Corbett, Government Entomologist, has for the past two years contributed quarterly to this journal an interesting series of Entomological Notes.

Much of the information given in these Notes is the result of recent investigations and foreshadows more exhaustive accounts to be published either in these pages or as Special Bulletins.

We suggest that it is to the advantage of all planters to glance through the Notes as they appear, to ascertain whether references are made therein to pests of particular crops on which they are interested.

A large number of enquiries are received by the Entomological Division of the Department from planters whose crops are damaged by insects pests, and

we would emphasise that it is always advisable to notify the Entomologist as soon as possible of the existence of a pest which threatens to cause widespread damage so that, if necessary, action may be taken to restrict the area damaged and to combat the insects before they become too numerous.

It may be pointed out, however, that much waste of time can occur through failure to give full information regarding the extent and nature of the damage caused by an insect pest, as well as through lack of observation of proper precautions in sending to the Department specimens and material for examination. On this account, Mr. Corbett includes in his Notes in this issue "Directions for Mailing Specimens of Insects" which were first published in this journal twelve years ago.

Inter-Departmental Agricultural Conference. The principle that a country should concentrate on the production of crops for which it is pre-eminently suited and rely on imports of such other agricultural products as it requires, the local cultivation of which is likely to prove less remunerative, is a policy with which we are in agreement. It results in adequate world supplies and the most economic production.

The application of this policy to Malaya has in the past proved of material benefit and we have no cause to regret the fact that this country has taken such a large share in supplying the world's requirements of rubber.

The fact that the world demand for rubber is at present adequately catered for is no reason for the elimination of the present areas under this crop, except in such areas as are obviously unsuitable. It does, however, make more imperative the necessity of finding other avenues for agricultural enterprise.

Furthermore, the present situation has emphasised the desirability of increasing the production of foodstuffs, provided that such industries are capable of economic development.

It is from this point of view that we shall approach the work of the Inter-Departmental Agricultural Conference, the objects of which are set forth in the Departmental Notes included in this issue.

Original Articles.

COCONUTS AND COPRA IN 1931.

Shipments of Copra and Coconut Oil.

The total estimated world shipments of copra in 1931 were 803,020 tons, as compared with 812,883 tons 1930 and 877,869 tons in 1929. The average annual world shipments for the period 1927-31 were 823,392 tons, as compared with 631,423 tons annually for the period 1922-26. The year of greatest shipments was 1928, with 905,732 tons.

The following are the approximate figures of shipments of copra from the chief producing countries in 1931 and the gross imports of the most important consuming countries for the same year.

COPRA SHIPMENTS.			COPRA IMPORTS.		
		Tons.			Tons.
Netherlands India	...	360,000	United States of America		240,000
Philippines	...	178,000	France	...	192,000
Malaya	...	176,000	Germany	...	143,000
South Sea Islands	...	100,000	United Kingdom	...	93,000
Ceylon	...	89,000	Holland	...	87,000
Zanzibar	...	15,000	Denmark	...	71,000

The following shews the chief exporters and importers of coconut oil in 1931.

COCONUT OIL EXPORTS.			COCONUT OIL IMPORTS		
		Tons.			Tons.
Philippines	...	158,219	United States of America		145,167
Ceylon	...	48,139	United Kingdom	...	43,423
India	...	22,307	Germany	...	6,651
Malaya	...	10,159	France	...	5,000
Netherlands India	...	3,367			

Copra Prices.

There have been considerable fluctuations in prices. During the first half of the year the downward trend in values continued. Commencing at £15 5.0, the average price of Straits F.M.S. copra, c.i.f. London, for January, 1931, values declined to an average for August and September of £11.17.6. In June the quotations at one time touched as low as £10.17.6 for D.E.I. and Straits F.M.S. copra.

A sharp appreciation in price was occasioned by the departure of Great Britain from the Gold Standard. For October the price for Straits F.M.S. averaged £14.5.0 and for December £15.7.6.

During October and November, due to large arrivals at Marseilles and the poor demand on the part of the French Crushers, prices of D.E.I. and Straits

F.M. and South Sea kiln-dried copra fell heavily, there being a wide discount for F.M., South Seas and Straits F.M. as compared with the Straits F.M.S. quality.

While this low level of prices was ruling, U.S.A. buyers entered the market and bought fairly heavily for January and February shipments. The pressure of supplies on Marseilles being relieved, prices recovered to more or less normal parity with other grades.

Messrs Frank Fehr & Co. in their review of the copra market for 1931, make the following very interesting observations regarding the supplies of Ceylon copra.

"A further outstanding feature has been the movements in the price of Ceylon copra. The normal premium of say 10 s. to 20 s., which is obtainable for Ceylon F.M.S. copra over Straits and D.E.I. F.M.S. copra, has increased, and at the end of January Ceylon was quoted at about £4 premium. This is due to the falling off in arrivals and to a phenomenal demand which has arisen since November for Ceylon oil in India.

"Commencing from 1st. January, 1932, there was a reduction in the Indian import duties on Ceylon copra of £1.10.0 per ton, and on Ceylon coconut oil of £2 per ton.

"The present duty is about £6 per ton on coconut oil and £3.5.0 per ton on copra.

"Unless, therefore, the supplies of Indian copra increase, the diversion of large supplies of Ceylon copra to India will be a permanent feature, and, in consequence, the surplus available for export from Ceylon to Europe will tend to diminish

"The present price of copra in Ceylon is at a parity of £20 c.i.f. Europe, compared with present price of £17.10.0 c.i.f. Europe for Straits F.M.S. copra.

"The average price of Straits F.M.S. copra in December, 1931, was £15.7.6, and this works out upon a gold basis to £11.2.6, or near to the low record price for copra. There are signs that at this level exports are effected and that larger quantities are retained for consumption at origin".

Prices of Coconut Oil.

Prices of Manila coconut oil, c.i.f. New York reached unprecedented low levels during 1931. The year started with an average price in January of 5 cents per lb., which had been reduced in December to 3 7/8 cents.

At various periods during 1931 offers of Manila coconut oil were made to the European market at attractive levels, but did not result in any business of importance.

From August to early November, an especially large business was done in Ceylon coconut oil to European ports, at prices which were thoroughly competitive with European crushed oil. During December, however, India was prepared to pay better prices than were obtainable in Europe, and subsequently practically no business was possible to the United Kingdom or the Continent.

The Indian demand is chiefly due to the high prices ruling for Malabar copra. The business was also assisted by the Indian Government having reduced the import duty on Ceylon coconut oil: the reduction in the duty equals about £2 per ton.

Prices of Ceylon coconut oil during 1931 declined at about the same rate as for other vegetable oils, but towards the end of the year they shewed a remarkable recovery.

The year started with an average price in January for Ceylon mill oil of 24 s. 3d. per cwt., c.i.f. usual European ports. Almost without any reaction, prices declined, the average for August being 18 s. 9d. The lowest price at which business was done was 16 s. 6d. During the early part of September an improvement set in, which, during the latter part of that month, was assisted by the fact that the British Government temporarily abandoned the Gold Standard. In December the average price had recovered to 25 s.

The Malayan Copra Industry in 1931

During 1931 the market for coconut oil, as for other vegetable oils and fats including palm oil, was adversely affected by the economic conditions which prevailed during the year. The production of all raw materials of this type has increased enormously during the last two or three years, being in 1931 approximately 50 per cent. higher than a few years before, while at the same time consumption has failed to expand in the same manner. Market prices sagged more or less continuously until September when they were sharply affected by the suspension of the Gold Standard and the chaotic state into which the principal exchanges were thrown in consequence. Two factors appear to have influenced the situation, namely, that as a result of the accumulation of stocks of whale oil, the whalers decided to lay up their fleet in March 1931, as the surplus available was regarded as sufficient to cover the demands for the next twelve months. The other factor which has influenced the market has been the disturbed conditions in Manchuria which have seriously curtailed the supplies available of soya bean oil. It should be emphasised that as these markets for edible fats are all connected, the disturbance of any source of supply necessary affects the position of other industries.

Local Prices.

In relation to copra the market opened in January at \$5.73 per picul for Sundried and \$5.30 per picul for Mixed. It declined more or less steadily until June when a low record of \$3.80 per picul for Mixed was established. Thereafter small rises took place, but towards the end of the year the position improved considerably, the average price at Singapore was \$5.71 per picul for Sundried and \$5.09 for Mixed.

The average Singapore price of copra Sundried and of Mixed qualities during the year were respectively \$5.09 and \$4.64 per picul as compared with \$7.80 and \$7.45 for 1930.

The local prices in the costal villages for copra prepared on primitive kilns from nuts grown by small-holders have ranged from \$2.50—\$4.50 per picul, and the prices of nuts for copra from 80 cents to \$1.80 per hundred. In the inland villages nuts sold for eating purposes at prices varying from 2 to 10 cents and averaging about 5 cents each, according to the size of the nuts and the supply locally available. In many of the inland districts nuts have to be imported from the coastal areas to meet the demand for local consumption.

Area Planted in Malaya.

The statistics for the area under coconuts have not been revised as it is considered that the very close census taken in 1930 continued to represent the planted area. The 1930 census placed the area under the crop at approximately 600,000 acres.

Malayan Export and Production.

The export of fresh coconuts in 1931 was almost identical with that of the previous year being 10,648 tons. The net exports of copra were 100,809 tons valued at \$9,677,676 as compared with 102,014 tons valued at \$15,307,511 in 1930. In view of the fact that net exports of coconut oil in 1931 were 9,909 tons or 436 tons greater than in the previous year, it may be assumed that the production of copra in the year under review was practically the same as in the previous year.

It is difficult to form even a rough estimate of the total production of coconuts in Malaya. While it is true that some 90,000 acres of estates together with well defined blocks of small holdings are situated in the coastal districts of Perak and Selangor, it has also to be remembered that a few palms are commonly planted near the dwellings of many Malays and other Asiatics throughout the country. The crops produced on estates are utilised almost entirely for the production of copra, but in the coastal districts the crops from small holdings are used both to satisfy the local demand for fresh nuts and for conversion into copra, while nuts produced in the inland districts are all consumed fresh. Moreover, a small portion of the copra made is purchased by two oil mills in Selangor, the oil and cake from which are not expected in large quantities. Consequently, the known exports of copra have little relation to the total production of nuts, more especially as the crop of nuts per acre and the number of nuts per picul of copra are subject to wide variation.

Investigations.

The standardised coconut experiments laid down in 1930 on five estates in the Federated Malay States and two in the Colony have been continued, but have not yet been in progress long enough to give definite results. Selection, cultivation, manuring and cross-pollination experiments have been continued at the Experiment Station, Klang, and on Carey Island.

Investigation on improved methods of preparing copra, which are being

undertaken with financial assistance from the Empire Marketing Board, have commenced to give valuable information. The officer engaged in this work visited Ceylon in August to make a comparative study of methods of coconut cultivation and copra preparation in that Island. A report giving the results obtained to the end of 1931 has recently been published. It has been definitely established that Malayan copra is inferior in quality to that prepared in Ceylon, and that this inferiority is due less to climatic factors than to careless harvesting of nuts on small holdings and to methods of preparation on properties of all sizes which frequently leave room for improvement. Of particular importance in lowering the quality of the copra produced are defects in the details of construction of the kilns used. Existing kilns on a number of estates have been found to exhibit one or more such defects which can, however, as a result of these investigations, often be remedied at a comparatively low cost. Kilns used by small holders, or middlemen manufacturing copra on a small scale, are usually very primitive. Consequently, investigations are in progress with a view to providing a standard design of small, cheap, but efficient kiln.

Enquiries into local marketing methods and associated economic factors indicated that the first steps towards improved local prices in the principal areas of small coconut holdings are the preparation of copra by the growers themselves, in preference to the sale of the nuts to middlemen manufacturers, and improvement in the quality of the product by better methods of harvesting and by the use of small cheap kilns of approved design, erected in fairly large numbers to serve groups of neighbours throughout these areas. In Kuala Selangor District two or three members of the community have erected kilns designed by the Department of Agriculture and have prepared copra of improved quality, selling for prices which have not only given them a better profit on their own nuts, but have enabled them to purchase nuts from their neighbours at prices above those given by the local middlemen manufacturers.

Pests.

The coconut beetle (*Oryctes rhinoceros*) was kept under control throughout the year by the usual methods of destroying suitable breeding places. The nettle caterpillar (*Setora nitens*) appeared again in one district in the first half of the year and on one or two estates required special efforts on the part of the managers to effect its control.

Acknowledgments

The information on shipments and prices of copra and coconut oil are abstracted from the "Review of the Oil Seed, Oil and Oil Cake Markets for 1931" published by Messrs. Frank Fehr and Company to whom we tender our most grateful thanks.

The portion of the above article dealing with the Malayan Industry in 1931 is part of the Annual Report for 1931 of the Director of Agriculture, S.S. and F.M.S.

COPRA PRODUCTION BY THE MALAY SMALL-HOLDER

BY

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Introduction.

A letter received in July 1930 from certain residents of the mukim of Jeram on the Selangor coast revealed that the owners of coconut holdings were in considerable financial difficulty owing to the low price paid by dealers for their coconuts.

As a result of this letter, officers from the Agricultural and the Co-operative Departments proceeded to investigate the position, to determine whether the financial circumstances of the small-holders could be ameliorated.

The Jeram Malay Reservation.

The reservation, which is situated on the Kuala Selangor road, consists of 1,367 holdings, all under 100 acres, made up as follows:—

Mature Coconuts (approx. 30 years)	...	4,361 acres
Immature Coconuts	...	897 "

The usual size of a holding was about 6 acres, and each supported one large family.

In appearance, the palms were exceptionally good for small-holding conditions, and they gave an abundant crop of large nuts.

Crop Disposal.

The practice adopted by the Malays in the disposal of their coconut harvests has generally been to sell their nuts while they were still on the palms to a middleman producer, who usually harvested every sizable nut, with the result that an extremely large percentage of very unripe nuts was included in the crop taken.

Thus a loss was incurred, since some 300 nuts would be required to make a picul (133½ lbs.) of copra, whereas using only ripe nuts between 230 and 250 nuts would yield a similar quantity of copra.

Furthermore, the presence of these unripe nuts and careless methods of preparation, in addition, gave copra of low quality and high moisture content, with the result that a low price was received by the middleman producer from the local dealer.

It will be appreciated, however, that while the middleman producer, the local dealer, and the ultimate buyer could all operate on the basis of a regular

percentage on turnover, the whole of the financial loss occasioned by careless methods was borne by the grower, who received a low contract rate for his nuts.

Forward Contracts and Debt.

The situation was further complicated by the fact that a large number of the inhabitants of the Reservation were in debt and as a result had been compelled to sell their crop forward at a very low price. While the usual price paid for average-sized nuts, delivered at the roadside, to the "free" small-holder was about 14 cents for 10 nuts, as little as 1 cent a nut was recorded as a forward contract made in good times, where the whole of the work was organised by the middleman producer, and where a condition of serious indebtedness existed.

It was estimated that of the 1,367 holdings

30 per cent. that is some 400 were free of debt

40 per cent. that is some 550 were free of forward contracts but not of debt

30 per cent. that is some 400 were in debt and tied by forward contracts.

The Income of the Small-holder.

It will be appreciated that a good 6 acre holding, yielding some 15,000 nuts per annum would normally provide a "free" owner, at the average price quoted, with an annual income of about \$210 from which he would have to find certain expenses of upkeep. A less prolific area of the same size, the owner of which was in debt and receiving only 1 cent per nut would obtain only \$100 for his annual crop.

Possibilities of Improvement.

With nuts priced at 14 cents per 10 and using ripe nuts only, the equivalent value of the dry copra will be \$3.29 per picul. Sundried copra, valued at \$6.75 at Singapore, will be worth about \$5.75 at Jeram, so that the balance available, if careful production is practised, is \$2.46 per picul.

The middlemen producers, however, generally produce "mixed" or even lower grade copra, and on the assumption that 280 nuts of assorted ripeness will be required to make a picul of dry low grade copra, worth locally \$5.00, it may be estimated that the intermediaries between them absorb about \$1.10 per picul in commission charges for collecting, transporting and preparing nuts, for preparing and bagging copra and for the financial risks incurred.

Thus the avoidable loss to the grower, and incidentally to the trade of the country, amounts to over \$1.00 per picul of copra traded. On the basis of 10,000 tons of small-holders' copra as a nett annual export, the loss to the country may exceed \$1,200,000 annually, since similar and worse conditions exist in all districts where such copra is manufactured.

Efforts by the Small-holders.

Financial adversity had already induced the more progressive to make some efforts on their own behalf and at the time of the first visit, 8 kilns had recently been erected, but owing to inexperience and to the crudity of the kilns, the quality of the copra produced was most unsatisfactory.

The safe low price of only \$4.00 per picul was offered for their half-dried or "wet" copra by the speculative local dealer, but even this price was sufficient incentive to continue production, since the equivalent nut price is approximately equal to 16 cents for 10 nuts which is an advance of 2 cents on simple nut sale.

Preliminary Conclusions.

The conclusions arrived at as a result of these preliminary investigations were as follows—

- (1) The exceptionally low price for nuts was caused in the first place by the world financial depression.
- (2) Relatively low prices for nuts, however, are always paid by the middleman producer to the grower.
- (3) These low prices are due to two causes—
 - (a) Careless methods of copra manufacture by the middleman producer, who receives a low price for his copra from the dealer.
 - (b) The frequent indebtedness of the grower to the middleman producer.
- (4) A central organisation for purchasing wet deteriorated copra and redrying and grading it, would not bring better prices either to the producer or to the grower.
- (5) Prevention by law of dealings in low-grade copra is impracticable.
- (6) Increased manufacture of copra by or on behalf of growers is therefore essential. The erection of a large central drying depôt is not to be recommended owing to the inaccessibility of the small holdings.
- (8) The erection of small kilns of improved design, suited to the needs of growers and small groups of small-holders offers a likely solution to the difficulty.
- (9) It is quite probable that the small-holders will revert to simple nut sale when prosperous times return.

Experiments with Small Kilns in Kuala Selangor.

Two small-holders were selected by the Malay Agricultural Assistant, Kuala Selangor, for special instruction and assistance in copra manufacture.

The objects of the experiments were as follows—

- (1) To demonstrate that good copra could be made on small inexpensive kilns.
- (2) To determine what response was forthcoming from the small-holder.
- (3) To ascertain what marketing difficulties were to be expected.

Work was commenced in August 1931 and by February 1932, one producer was in a position to make copra of No. 1 quality.

Scheme 1.

A Javanese small-holder, a man of some wealth and the owner of 20 acres of mature coconuts, was persuaded to rebuild his crude kiln, using brick and iron as materials of construction. The kiln, when completed, was too large for his own requirements, since his annual crop amounted to only one ninth of the kiln capacity, and so when the production of good dry copra had become an accomplished fact, it was decided to push the scheme a stage further. The owner was accordingly persuaded by the Malay Agricultural Assistant to assist his countrymen and incidentally to reduce his own overhead charges by extending his business. The kiln owner, in turn, persuaded twelve of his neighbours, owning between them some 60 acres of mature coconuts, to consider two alternatives, either—

- (a) to sell all their nuts to him, or
- (b) to allow him to manufacture copra for them on commission.

The first alternative was chosen, so leaving the kiln owner the sole responsibility of manufacturer and marketing, and incidentally, giving him a satisfactorily large quantity of copra for him to approach a large dealer.

The Purchase of Contributors' Nuts.

His method of nut purchase allowed for fluctuations in the price of nuts and for seasonal variations in the ratio of nuts required to make a picul of copra. An example may be quoted—

January 1931 —

235 nuts = 1 picul of copra.

Therefore 100 nuts = .42 picul of copra.

Hence with good dry copra (i.e. "sundried") fetching \$6.75 (Singapore) and say \$5.75 locally, the copra value of 100 nuts was $.42 \times 5.57 = \$2.32$.

From this, he deducted a manufacturing commission of 30—35 cents per 100 nuts, so leaving a balance of about \$2.00 which he paid to his contributors. This is equivalent to a price of 20 cents for 10 nuts.

Competition from Middleman Producers.

The response on the part of the middlemen producers was to advance the price of nuts by approximately 30 per cent. in order to undermine the loyalty of this unwelcome organisation and pressure was also brought to bear on the dealer who bought the copra from the owner of the new kiln.

Owing to the high quality of the copra he produced, the Javanese manufacturer was always able to pay 2 cents per 10 nuts in excess of the middlemen's top price while the intimidation of the dealer was stopped and his continued support secured as a result of the efforts of the District Officer, Kuala Selangor.

The exceptionally high price offered for nuts attracted considerable attention to this man's work, so that after the first month, no further difficulty was experienced in obtaining sufficient nuts to keep his kiln in continuous operation.

Scheme 2.

A Malay small-holder, the owner of one of the eight crude kilns, previously referred to, was easily persuaded to build a small kiln of improved design, since his first efforts on his own kiln gave a product which was almost unmarketable.

His resources did not permit of the expense of brick and iron constructions and instead clay, coconut timber and attap were used.

Some difficulty was experienced, initially, in persuading the owner to follow a satisfactory method of production, but ultimately he was able to produce copra which was better than average middleman's copra. Since, however, he could not obtain top price, he was unable to offer a high price for nuts and so could not attract regular contributors to his kiln, which was of sufficient capacity to deal with the crop of at least three average-sized small holdings.

The Effect of these Experiments.

On Copra Production.

The most outstanding and direct result of these endeavours is that the number of kilns owned by Malays in Jeram has increased progressively, thus—

August 1930	...	...	...	...	6
November 1930	...	...	...	...	30
August 1931	...	...	...	...	35
February 1932	...	...	...	...	120

It cannot be claimed that all these Malay producers are manufacturing good dry copra; in fact, the converse has definitely been stated by an important dealer, viz. that "Malay-produced copra is, in general, much inferior to middlemen producers copra, bad as that is!"

This is due to the fact that at present, effective supervision is impossible and that under existing conditions, individual or group education cannot be undertaken. Whatever progress has already been made is the result of imitation, and lacks the corrective of close criticism.

This indicates that, without adequate instruction, the copra received is likely to be of very mixed quality and that an ambitious large-scale organisation for co-operative marketing of their produce would involve complicated dealings, if profit is to be justly apportioned, and additional expense, on account of the necessity for redrying and grading the product before sale.

On Copra Prices.

Originally and with similar Singapore prices, a standard price of \$4.00 per picul was offered for the "wet" low-grade copra produced on the six crude Malay-owned kilns.

The Javanese producer is now obtaining \$5.75 for his dry "Sundried" copra, the Malay \$5.00 for his dry "mixed" copra, while the imitating Malay small-holders are obtaining between \$4.40 and \$4.80 for their "wet" low-grade copra.

On Nuts Sale.

These two small schemes have resulted in a similar general improvement, and whereas originally 1 cent and 1.4 cents per nut was recorded for "tied" and "free" growers, the price now offered is about 1.4 cents and 1.8 cents respectively, while the Javanese producer, in an unassailable position, is able to offer 2 cents and still prosper.

Further to prove this contention, the case of the near-by District of Kuala Langat may be quoted, since in September 1930 the position as regards nut prices here was the same as in Jeram. A condition of almost general indebtedness is understood to exist and copra production by the small-holder has not yet been inaugurated. The nut prices are now approximately 1.2 cents for "tied" and 1.5 cents for "free" sellers respectively, while the dry low-grade copra of the middleman producer is valued at only \$4.65 per picul, equivalent to \$4.20 for undried or "wet" low grade copra.

Statement to illustrate the improved financial circumstances of the

Small-holder who makes copra.

Basis: "Sundried copra = \$6.75 per picul (Singapore).

Note: The Singapore copra prices in September 1930 and February 1932 are comparable, but local nut prices have since improved as a result of competition.

Estimated nett annual income	By Nut Sale.				By Copra Manufacture.			By other sources
	To middleman producer.			To Javanese	Using own nuts and making on own kiln		Using own & bought nuts	
	Sep. 1930.		Feb. 1932.	Feb. 1932.				
	If in debt	If free	If free	By contri- butors	Bad Copra	Good Copra	Good Copra	
	\$	\$	\$	\$	\$	\$	\$	\$
Javanese owner of mature 20 acre holding	—	590	—	—	710	985	1,195	—
Malayan owner of good 6 acre holding	150	210	235	300	310	355	—	—
Dealer in good dry copra above, (commission)	—	—	—	—	—	—	—	324
Cooly, employed by Javanese above (wages)	—	—	—	—	—	—	—	163

Conclusions.

- (1) It has been shown that increased education of Malay small-holders in improved methods of copra production where conditions are favourable can succeed.
- (2) It is essential that capital must be forthcoming either from a single individual or from a small group of neighbours who are prepared to work together.
- (3) Only dry copra of good quality must be manufactured so that a sufficient margin of additional profit is available to put the producer in an unassailable position.
- (4) If the kiln has a single owner, he must be fair-dealing and his contributors should preferably be men who are free of debt and are hence unassailable.
- (5) Finally, a satisfactory price must be obtained for the improved copra. If a local dealer willing to pay a fair price is not to be found, it will be necessary to go further and organise transport of the copra to larger buyers.

Recommendations for the Construction of Smoke Kilns for use by Small-holders.

General.

The copra-drying platform should be at least 6 feet from the fires, while the fires and the copra should be completely shielded.

An economic small unit would therefore be a closed chamber 6 feet high, 6 feet long and 6 feet wide, entirely surrounded by a large attap shed sufficiently large to provide storage space for shell fuel, finished copra and working room.

Consideration of Size.

If all the sides of such a square kiln are extended equally, the capital cost per square foot of drying space decreases thus:—

<i>Kiln</i>	<i>Drying Area</i>	<i>Length of 6 feet walls</i>	<i>Relative cost per sq. foot of drying area</i>
6 feet x 6 feet x 6 feet	36 sq. feet	24 feet	.666
12 feet x 12 feet x 6 feet	144 sq. feet	48 feet	.333
15 feet x 15 feet x 6 feet	225 sq. feet	60 feet	.266

If two of the sides are extended so as to give an oblong kiln, the relative cost per square foot of drying area increases. The advantage of greater convenience, however, outweighs this consideration, in the case of large estate kilns.

Since conditions in small holdings normally do not allow of large scale manufacture, only two types of kiln need be considered—

- (A) 6 feet x 6 feet x 6 feet or nearest
- (B) 12 feet x 12 feet x 6 feet.

Capacity.

The former (A) is intended for individual small holdings from 6 acres up to 20 acres in extent; the latter for larger small holdings, or for use by groups of contributory small holdings. Allowing for fluctuations in crop, which may frequently vary as widely as 3 : 1 or even more, and for careful production, by which only a thin bed of copra is dried at a time, kiln B should easily be able to cope with the crop from 80 mature acres of good yielding coconuts.

The normal provision on estates lies between $\frac{1}{4}$ square foot of drying area per acre (which is much too little) and 2 square feet per acre (which is correct), so that Kiln B has a recommended outside limit of about 100 acres. At 20 nuts per square foot, its correct working load is 2,800 nuts every four days.

Details of Construction of the Kiln.

1. Especially if the kiln is to be in continuous use, the walls must be designed to retain heat and radiate it uniformly. Hence galvanised iron and attap are unsatisfactory materials for the kiln walls.

2. With kiln B in discontinuous operation, a 9 inch brick wall was decided upon, but for larger kilns in regular and continuous use 15 inch walls, although more costly, will retain more heat and so lead to greater clean heat utilisation and more uniform drying.

- 3 Walls constructed of heavy alluvial clay have not proved entirely satisfactory, since unless constant attention is given to re-luting the cracks as they appear, the excessive shrinkage of clay will lead to the ultimate collapse of the walls.

Where, however, the local clay is of lighter texture and contains a suitable proportion of sand (e.g. Kuala Langat District), clay may be rammed on to a core of woven sticks and if planks are used to shape and build up the walls, a satisfactory kiln will result.

Normally, binding agents are necessary to prevent the formation of large cracks, while a mixture composed of about 80 per cent heavy clay, 10 per cent. sand, and 10 per cent local lime has, after puddling together, resulted in a most solid wall.

Recommended binding agents are—long dry “lallang” grass, string or broken rope, and if the mass is well rammed, padi husk. The core of the wall may be composed of platted sticks, light expanded metal, chicken wire or stacked coconut husks.

The materials to be recommended in any one district naturally depend on local conditions, but undoubtedly brick construction will give more permanent service and is to be recommended wherever its use is possible.

4. Trenches 9 inches deep, excavated in the earth of the fire-pit have been



Plate 1.—A PRIMITIVE COPRA KILN
Dimensions : 6' x 6' x 3' high
Note: Steps in foreground.

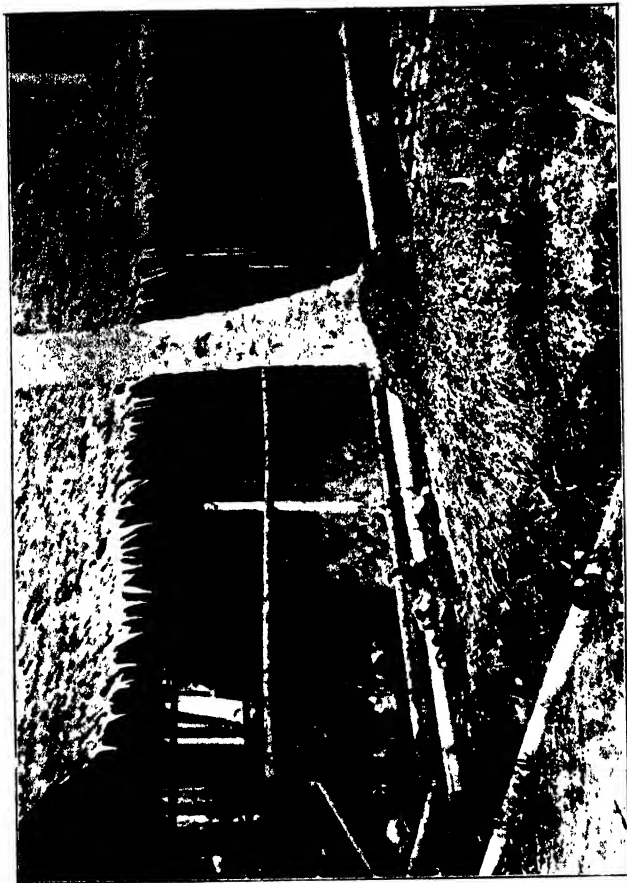


Plate 2.—CLAY COPRA KILN

The enclosing shed has been opened to show the kiln. *Note.* This kiln has been in use two months and large cracks may be seen.

found helpful in arranging and shielding the shell fires from draughts.

5. It has been stated that the large kiln may not always be working to full capacity, and it is therefore essential that provision should be made against the eventuality of lean harvests by providing a cross-wall in the fire pit to extend from the ground up to the copra platform so that, if desired, only one half of the kiln may be used without any detriment to the copra by reason of irregular drying.

Uprights in the fire-pit should be of brick, angle iron, iron pipe or stout timber protected by tin plates, otherwise there is a danger of fire.

6. Iron as a material of construction for the copra platform is good, but will account for quite half of the total capital expenditure. Nibong or bamboo slats are not so permanent nor yet so tidy, and an alternative of wooden laths screwed to stout cross beams is to be tried. In all cases it is strongly recommended that local scrap yards should be inspected before the purchase of any steel work.

7. The copra should be shielded from draughts by means of a brickwork rim, 15 inches high, surrounding the copra platform. Alternatives are planks, baulks of timber, or flattened galvanised iron, reinforced by a wooden framework. These have the advantage of portability.

8. A shed to enclose the kiln proper is necessary to screen the kiln from draughts, so that humid air over the copra is kept warm and is unable to deposit its moisture on the topmost copra. By maintaining warm conditions it also increases the heat efficiency, but there must be free escape through the roof for the saturated air, otherwise stagnant conditions will arise, and drying may even be locally suspended to the detriment of the copra.

9. The shed may also serve as a store for copra, for shell fuel and for unripe nuts which need to be matured. Shutters should be provided if the shed is too dark and secure doors are advisable.

10. If a high piece of land is chosen, an excavation some 1 to 2 feet below ground level will bring the drying platform conveniently nearer the ground and will also provide better heat retention and radiation. Alternatively, the ground surrounding the kiln may be built up some 2 feet.

11. No ventilation holes need be made in the walls of the fire pit, but some provision is advisable for smoke escape. In Kiln B the height of the girders allowed for a 2 inch gap between the copra and the top of the brick work. Alternatively, a small gap can be left on the kiln platform between the copra and the copra screens.

Advice on Copra Production.

1. As far as possible, only fully brown nuts should be harvested.
2. If some unripe nuts have to be collected to avoid theft, they should be sorted out and left to mature for one month.

3. The nuts should not be split open until the very last moment prior to drying. If, owing to local conditions, split nuts have been carried to the kiln from the field in sacks there must be as little delay as possible in applying heat.

4. If there is an amply supply of shell fuel, use only the halves which are clean and free from husk. Mature shell is preferable to immature shell, and the supply should always be kept in a dry place.

5. During fine weather, copra should always be partially sundried before kiln drying. If rain threatens or the sky is overcast, the copra should on no account be laid out on the ground or the concrete barbecue, but should be put at once on the kiln.

6. During certain months of the year, notably March, September, October and November, it is advisable to suspend all pre-drying in the sun completely. At other times, should the sky become overcast, very little drying takes place.

7. In certain districts, middleman-producers sun-dry their copra for 5 days after kiln drying. Generally, this is a most unsatisfactory practice, though in good weather excellent copra can often be obtained.

8. The only sound procedure is to sun-dry for 8 hours (one day). This will remove a quarter of the total moisture, and will dry the surface so that husk and smoke cannot subsequently adhere. Care must be taken that all the halves are carefully drained of milk and are laid out face upwards.

9. The same evening, the copra must be placed on the kiln and a shell fire started.

10. A fire with 200 half shells arranged in pairs in a continuous line in the form of a "U" will in a 12 feet x 6 feet fire pit last 10 hours, and will not normally go out before it has completely burnt out.

11. For the following two days, two such fires may be lit at opposite ends of the kiln every 10 hours.

12. On the morning of the fourth day after sun-drying, a single fire is again advisable, otherwise there is a danger of the copra becoming discoloured or burnt.

13. The sacks used for copra transport and the store itself should be kept clean and periodically inspected for insects.

(A) Do not sell under-dried or "wet" copra.

(B) Do not allow copra containing any excess moisture to remain at cold shade temperatures for more than one hour.

The Quality of Copra required by the Oil Mills in the District.

Where, as in Kuala Selangor, a different price is paid for each lot of copra, the following points are taken into consideration by dealers (1) dryness, (2) absence of immature pieces of copra, (3) absence of smoke or colour.

Details of Kilns.

DETAILS.	SCHEME 1.	SCHEME 2.	POSSIBLE ALTERNATIVES.
Size :			
Size	6 ft x 12 ft x 6 ft high	6 ft x 4 ft x 6 ft high	Large Estate kiln : 50' x 12' x 7' high
Drying area	144 square feet	24 square feet	600 square feet
Equivalent acreage	72 to 144	12 to 24	300-600
Recommended acreage	100	15	400.
CAPACITY :			
Peak capacity	4,320 nuts	720 nuts	21,000 nuts (as normally worked but overloaded)
Average capacity	2,880 nuts	480 nuts	50 Tons.
Peak output per month	11 tons	2 tons	
Size :			
Roof	Attap	Attap	Tiles (Ceylon), Galvanised Iron, Slate
Sides	Rough Boards	Attap	Planks, Brick, Galvanised Iron.
Uprights	Poles	Poles	Iron Stanchions, Angle Iron, Square Timber. Brick, Piping.
KILN :			
Main walls	9 inches Brick	Clay and whole husk.	Clay mixtures, Galvanised Iron, Attap, Earth Pit (Philippines).
Cross walls	9 inches Brick	None	Galvanised iron sheeting
Copra platform	Thin iron rod	Nibong slats	Expanded metal, Perforated iron sheeting. laths, bamboo
Copra screen	Galvanised iron (flattened)	Coconut trunks	Brick Planks, Attap.
Beams	Light Girders	Coconut trunks	Heavy Girders, Scrap rod, Scrap rail, Angle iron, Timber
Uprights	4 inches iron piping	Coconut trunks	Poles, Brick, Iron stanchions, Timber.
Doors	Galvanised iron (flattened and strengthened)	Boarded	
Misc. :			
Estimated life	20 years	3 years	
Estimated cost	\$200.00	\$50.00	
Depreciation, upkeep and renewal cost	\$31.00 p a	\$20.00 p a.	

Moisture.

The moisture content of small-holders' copra, as marketed, varies between 6 and 20 per cent. so that, after allowing for the excessive moisture content of "wet" copra, one is able to calculate that the basic worth of dry low grade copra is \$5.00 per picul and that the true discount for poor quality or anticipated deterioration is thus 75 cents a picul.

All copra has to be sun-dried on concrete before milling and is dried to 5 per cent. moisture otherwise it would clog the machinery. The copra is then crisp and "musical", and emits a characteristic squeal when pressed.

Nothing is really gained by including an excessive quantity of moisture, owing to the graded system of discounts for excess moisture, unless a dealer is careless in his buying. Furthermore, originally wet "white" copra will generally arrive at the mills in a deteriorated condition.

Immature Copra.

Exception is always taken and a penalty inflicted by the oil miller if immature pieces of copra are present in any quantity. Such copra is rubbery and as a result, the extraction efficiency is low.

Smoke and Colour.

Smoke and colour in the original copra produces colour, smell and taste in the resulting oil and in the by-product oil cake. The oil when extracted, cannot therefore be classified as No. 1 quality and the residual oil cake may be rendered unpalatable and so unsaleable, except perhaps at a severe discount.

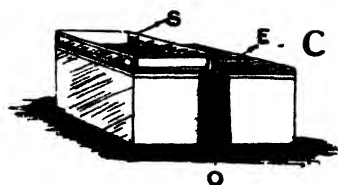
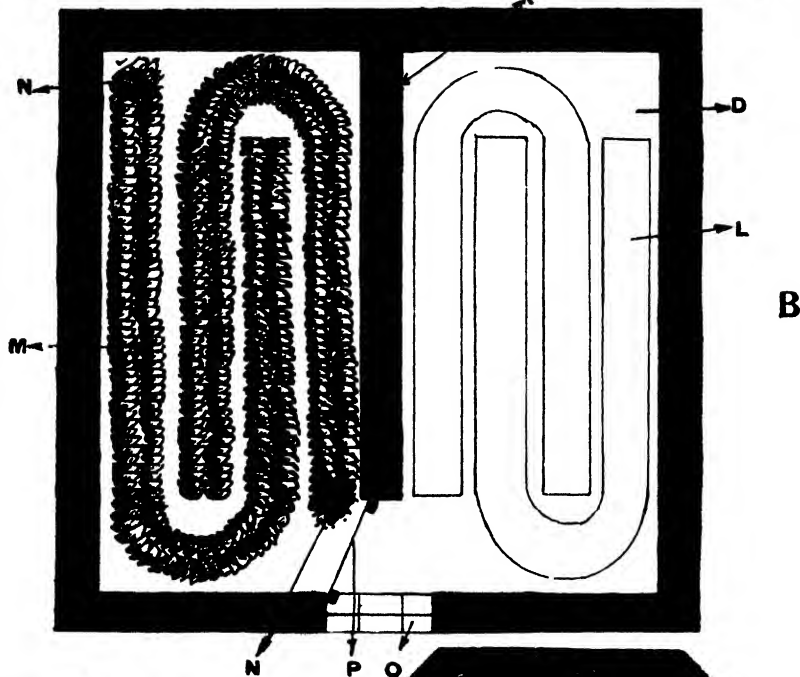
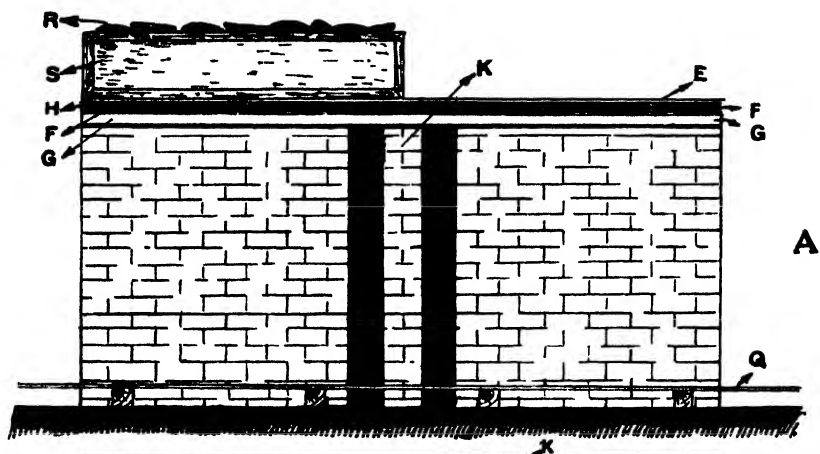
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Plate 3 CIVA MINUURI COPRA KILN
The attap house to enclose the kiln has yet to be erected
Note Copra shields and excellence of construction



PLAN OF BRICK COPRA KILN
Dimensions : 12' x 12' x 6' high

Key
To Diagram of Brick Kiln.

- A. Front view of kiln.
- B. Cross Section of kiln.
- C. View of kiln.
- D. View of attap and plank shed housing the kiln, and providing also a store for unripe nuts, dry copra, shell fuel and bags.
- (e) Copra platform of flat iron rods.
- (f) Light steel rail.
- (g) Light girder.
- (h) 2" smoke escape.
- (j) External walls (9").
- (k) Brick partition in fire pit.
- (l) 9" earth trench for shell fires.
- (m) Arrangement of continuous shell fires.
- (n) Fires.
- (o) Entrance to fire-pit.
- (p) Door to close section of kiln in use
- (q) Plank floor.
- (r) Copra.
- (s) Copra shield of reinforced galvanised iron.

COPRA DETERIORATION

BY

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AND

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The following abstract of an article, entitled "The depreciation of prepared copra by moulds and insects" by F. R. Passmore which appeared in the Bulletin of the Imperial Institute, Vol. XXIX (1931), No. 2 provides a useful basis for a consideration of copra deterioration.

The Opinions of Manufacturers and Shippers in England.

Preliminary enquiries have been made in England to ascertain the extent of the loss to the industry occasioned by insect attack and by the development of mould growths on copra, and to determine whether organised investigations to eliminate these features are justified.

Manufacturers in England are generally indifferent to the investigations, since they buy on the basis of the quantity and quality of the copra as received, so that the material losses resulting from deterioration and the expense of refining to eliminate free fatty acids, smell and discoloration, are borne by others. Furthermore, they do not keep large stocks of copra, which might deteriorate in storage.

Manufacturers of coconut oil do not consider that mould growth on copra is helpful to the expression or extraction of coconut oil. British manufacturers of edible coconut oil require copra that is clean and dry, with a high oil content and a low acidity. When coconut oil is used for low-grade soap making, a high oil content is the only factor demanded.

Representatives of firms engaged in shipping very low grade copra, consider that efforts to improve such copra are worth while, provided no great expense is entailed. Even they are covered against actual loss of weight in shipment by arrangement with the seller in the producing country.

Cases of inferior quality can always be traced to causes in the country of origin—except in such rare instances as "sea damaged".

The prices of the different grades of copra are based upon the average standard exported from each country of origin, and the following is a list in order of the relative market value of each at the time of the inquiry:—

Standard Copra Grades.

- | | |
|-------------------------|----------------------------------|
| 1. F.M.G.W.S. Malabar. | 9. F.M.S. Mozambique Plantation. |
| 2. F.M.S. Ceylon. | 10. F.M. Hot |
| 3. F.M.S. Seychelles. | Air Dried. Samoan Plantation. |
| 4. F.M.S. Mauritius. | (Crown Estates) |
| 5. F.M.S. West Indian. | 11. F.M.S. Java. |
| 6. F.M.S. Trinidad. | 12. F.M.S. Straits. |
| 7. F.M.S. Demarara. | 13. F.M.S. Dutch East Indies. |
| 8. F.M.S. West African. | 14. F.M. Galle. |

15. F.M. Hot		25. F.M.S.	Papuan.
Air Dried.	Samoa Plantation.	26. F.M.S.	South Sea.
16. F.M.S.	Samoa Plantation.	27. F.M.	Straits.
17. F.M.S.		28. F.M. Mixed	Dutch East Indies.
Standard.	Samoa (new grade).	29. F.M.S.	Zanzibar.
18. F.M.S.	Mozambique.	30. F.M.S.	Philippine.
19. F.M. Hot		31. F.M.	Philippine.
Air Dried.	Rabaul Plantation.	32. F.M.S.	
20. F.M.S.	Rabaul Plantation.	Trade	South Sea.
21. F.M.S.	Papuan Plantation.	33. F.M. Mixed	South Sea.
22. F.M.S.	South Sea Plantation.	34. F.M.	
23. F.M.S.	Samoa.	Kiln-dried.	South Sea.
24. F.M.S.	Rabaul	35. F.M.	Zanzibar.
F.M.G.W.S.	means	Fair Merchantable	Good White Sun-dried
F.M.S.	"	Fair Merchantable	Sun-dried.
F.M.	"	Fair Merchantable	(i.e. not necessarily sun-dried, therefore mainly kiln-dried)
F.M. Mixed	"	Fair Merchantable Mixed	(i.e. sun-dried and kiln-dried proportionately, but not necessarily 50 : 50).

The term "Sundried" is merely an expression of quality, and does not necessarily indicate the method of preparation.

The Condition in which Copra Arrives in England.

Since cargoes loaded in a damp and mouldy condition have dried out sufficiently before reaching Europe to render the moulds inactive, it is extremely difficult to determine the relative proportion in which different moulds attack copra by an examination of the product on arrival.

Contemporary and subsequent insect and mite infestation destroys a large amount of the dried mycelium, while sweating, drying out and rough handling of the product, reduce mould colonies to a mere discoloration of the produce.

Judging from the hordes of insects seen on infested shipments, the loss of copra by actual consumption must be considerable, and the production of "dust" by these insects is a common cause of arbitration for adjustment of price.

The three most prevalent insects found in imported copra during the survey were:—

- (1) *Necrobia rufipes*
- (2) *Oryzaephilus (Silvanus) mercator*
- (3) *Tribolium castaneum*.

In order to combat *Necrobia rufipes* which is the most prevalent pest encountered on arrival, one firm of importers proposes to institute regular fumigation of copra shipments with sulphur dioxide prior to their despatch to Europe

The Relations of Producers, Shippers and Manufacturers.

Copra as received in England has dried out *en route*, and accordingly arrives as a stable and reliable, if deteriorated, product. Since buyers in England pay only for what they receive and shippers are covered against possible losses due to further depreciation *en route*, it is only to be expected that they will not be interested in investigations which appear to be of no pecuniary importance to themselves.

The losses due to deterioration in transit, which are thereby indirectly but wholly borne by producers, are occasioned by (a) actual loss of weight, and (b) loss of quality. The penalties for the latter may take the form of price discrimination according to the country of origin, or if the quality has fallen below the recognised standard for that country, arbitration to determine what penalty be inflicted becomes necessary.

The average prices of leading "marks" during 1931 were as follows:—

					£.	s.	d.	
Malabar F.M.G.W.S.	...	...	...	...	15	4	0	per ton
Ceylon F.M.S.	...	...	...	...	14	14	0	" "
Java F.M.S.	...	...	...	...	13	19	0	" "
Straits F.M.S.	...	...	...	...	13	14	0	" "
South Seas F.M.S.	...	...	...	...	12	19	0	" "
Philippine F.M.S.	...	...	...	...	12	19	0	" "

It will be seen how severe is this price discrimination.

The Justification for Price Discrimination.

An explanation of the reason for the low price for low grade copra would be of interest to producers. As stated by Passmore, if the copra is of a particularly low quality, the utilisation of the derived oil is limited to low-grade soap-making but, in addition, if the by-product oil cake has a smoky and rancid smell, dark colour, and sour taste, it may be quite unsuitable for use as cattle food.

If the copra is of somewhat better quality, the derived oil will still need to be refined before it can be used for the manufacture of white toilet soaps and margarine, and price discrimination will then be in proportion to the cost of refining. This is made up of the normal operating charges, the cost of the materials used which is variable and the loss of neutral oil during the process which also varies.

During the process of refining, the free acidity is removed, by the addition of alkali, in the form of a dirty soap stock, sometimes difficult to dispose of from edible oil factories. This therefore limits the market for copra of intermediate quality to those factories where it is possible to utilise or dispose of such stock.

Brittle copra is preferred by manufacturers to soft rubbery copra, since it is easily broken and ground, a higher oil extraction is possible, and stoppages due to clogging in the silos and hoppers are less frequent. While oil is about four times more valuable than cattle cake in Europe, the copra is to be preferred which will, following a standard procedure, yield the most free oil and leave the same percentage of oil in the residual cake after each pressing.

The Causes of Copra Deterioration by Moulds and Insects.

It is obvious from the observations of Passmore and other workers whom he quotes, that the fundamental causes of the deterioration of a shipment of

copra are to be found in the country of origin. Careless methods of preparation, insufficient drying, the practice of blending poor with good copra before shipment and not the climatic conditions are the factors responsible for subsequent deterioration. If the copra is well-dried, the reabsorption of moisture during damp weather is not serious and under the worst conditions in Malaya, moisture is not taken up by dry copra beyond 8 per cent.

Investigations in Malaya and in Ceylon indicate that wet coconut meat and partially dried copra are always liable to serious bacterial attack unless certain precautions are taken, particularly during manufacture. The importance of this feature does not appear to be sufficiently emphasised by Walker. If bacterial attack is allowed to develop, low-grade copra will always result, and the seriousness of subsequent mould development and insect attack would appear to depend upon the extent to which the cell structure is initially broken down by bacteria.

The first symptom is a pale yellow gummy slime to which dirt and pieces of husk readily adhere while smoke deposition during the process of drying is frequently also severe. If, at this stage, drying is carried to completion, the danger of further depreciation is arrested, but it will be impossible to obtain white copra, and the colour of the resulting product will range between pale yellow and dark reddish brown according to the degree of bacterial penetration. Such discoloration is exceedingly common and is frequently distinguishable from actual burning, which is comparatively rare, only by smell.

If drying does not proceed continuously to completion, serious attack by penetrating moulds will ultimately set in and continued unsatisfactory conditions will produce a black, slimy wet, matted product owing to moisture of decomposition. Such copra may be redried before shipment either by exposure to the air or by admixture with good copra, while, during shipment, further drying will ensue owing to ventilation of the holds.

The conclusion of De Fremery* that cell degeneration by bacteria is a factor of great importance as regards the susceptibility of copra to insect attack has been amply confirmed both in Malaya and in Ceylon, and it has been observed that copra which has deteriorated or softened has a considerably greater attraction for copra-consuming insects than hard well-dried copra.

Observations on Specific Micro-organisms and Copra Insects.

Investigations have been carried out with two species of bacilli which are associated with the slime found on the white face of wet coconut meat during the early stages of the drying process.

They may be found either separately or associated, one being a short rod, averaging 3/1000 mms. in length, and the other, ranging between 6/1000 and 9/1000 mms. in length. When they first appear, the colonies of the two bacilli are distinguishable in that the former produce smooth, shiny, circular, colonies and the latter show a rougher surface and a more irregular type of colony.

* *Review of Applied Entomology*, April 1930, De Fremery.

The most favourable conditions for bacterial attack are provided when wet or half-dried coconut meat is exposed to cold humid conditions for long periods. The temperature above which the bacteria cannot live has not yet been determined.

The short rod appears to cause the initial deterioration of wet coconut meat and ultimately produces the marked corrosion and pitting together with the surface slime, which is found on copra where careless methods of preparation are followed. The long rod may be found both on wet coconut meat and on half-dried copra containing an average moisture content in excess of approximately 20 per cent. It is of course, the surface condition of the copra that is the deciding factor and it is accordingly not possible to be more specific. It would appear that this bacterium is of secondary consequence in breaking down the cell structure and initiating deterioration.

After the slime has been in evidence one or two days and has been allowed to become general, attack by *Carpophilus dimidiatus* is very marked, and this insect has even been found on the copra drying platform of a badly designed kiln. Subsequently, if unsatisfactory conditions are maintained, penetrating moulds appear and infestation by this insect becomes still more severe, particularly after invasion by the mould, *Aspergillus flavus*.

Necrobia rufipes known to the trade as the "copra bug" would appear to be essentially a warehousing pest which is introduced into estate copra stores through the agency of returned sacks. Wet mouldy copra appears to be much more attractive to this beetle than well-prepared dry copra.

The following rice pests are usually to be found in copra contained in old rice bags or kept in the neighbourhood of a rice store room :—*Silvanus advena*, *Silvanus surinamensis*, *Ephestia cautella*, and *Tribolium castaneum*. The use of old rice bags for transporting copra, unless they are carefully cleaned beforehand, will lead to insect infestation.*

Observations in Malaya indicate that serious attack by mites usually commences when the mould mycelium appears to be no longer active and, as observed by Passmore, they destroy the web, break down small irregular pieces of copra and so are largely responsible for the production of "dust".

Efforts to combat the nuisance caused by copra pests emanating from warehouses adjoining dwelling houses have actually been made in Malaya, involving fumigation of copra stocks, but the practice has been discontinued.

The following is a list of the more important micro-organisms to be found during the production of copra in Malaya :—

A. *On wet coconut meat*—Moisture: about 50 per cent.

On drying coconut meat—Moisture: 20—50 per cent.

Initially:

(1) Bacteria (penetrating)

* A fuller report is available. See *Malayan Agricultural Journal*, July 1931, Corbett.

Subsequently :

- (2) *Yeasts* (occasional)
- (3) *Aspergillus flavus* (penetrating) Yellow-green mould.
- (4) *Aspergillus niger* (penetrating) Black mould.
- (5) *Rhizopus nigricans* (penetrating) White mould which later becomes greyish black.

No. (5) is most in evidence when coconut meat is kept under conditions which do not permit of free air movement. No. (2) has up to now been found to be only of secondary importance.

B *On half-dried copra*—Moisture : 12—20 per cent. (3), (4), and (5) above.

C *On insufficiently dried copra*—Moisture : 8—12 per cent.

- (6) *Glaucus spp.* (superficial)
- (7) *Aspergillus tamarii* (penetrating)
- (8) Occasional moulds of lesser importance.

D. *On dry copra*—Moisture : less than 8 per cent

- (9) *Aspergillus cinnameus* (?) (superficial) Cinnamon coloured mould.
- (10) *Penicillium glaucum* (superficial) Green mould.
- (11) *Glaucus spp* (occasional) Green moulds

The Prevention of Bacterial Attack on Copra.

It is absolutely essential that bacterial attack on wet coconut meat or on half-dried copra should be inhibited if dirt and smoke adhesion, severe discoloration and attack by penetrating moulds and by copra consuming insects are to be eliminated. In practice, this is effected by the application of hot air before the bacterial attack has had time to develop.

Thus, it is essential to make the time between splitting the nuts open and applying heat as short as possible. It is not, however, sufficient merely to place the half nuts on the drying platform of the kiln without delay. The kiln should be already warmed up and it should be so designed that none of the copra will be exposed to draughts of cold air. Furthermore, it should not be so overloaded that cold and humid conditions can obtain on the top surface of the bed of copra. These may be caused either by lack of free air movement through the bed of copra or to overloading the rising hot air with moisture and incidentally chilling it in the process.

Unless precautions are taken therefore, conditions favourable to bacterial attack may exist for a very long time indeed.

The Time Factor.

Practical observation has shewn that the time factor depends on the humidity and the temperature of the air surrounding the copra.

A relative humidity of over 80 per cent. at any temperature under 30°C provides the necessary environment and under such conditions a bacterial slime

may commence to show in 4 hours, while in 8 hours, the copra will be irremediably spoilt. Attack by mould (3), (4) and (5), above, follows within 48 hours bacterial sliming unless the moisture content is reduced to below 20 per cent. within this period.

The time factor for superficial moulds varies with the conditions under which the finished copra is stored. Again, the atmospheric humidity is the controlling factor and where the stores are kept warm, dry and ventilated, there need be no mould development whatever. Under cold humid conditions of storage, however, superficial moulds may appear within a week. Such moulds, although unsightly, do not depreciate the value of the copra.

Conclusions.

If copra is carefully prepared and satisfactorily dried, a clean crisp white product is obtained, while subsequently only a superficial growth of mould will develop.

Furthermore, although insects may be found on such copra, if clean conditions of warehousing are observed, the attack is not serious. Crisp undeteriorated copra is preferred by crushers, and countries which export such copra in quantity receive a favourable price discrimination.

It has been observed by Grist* that no advantage is likely to be obtained by a single producer who succeeds in improving the quality of his individual output while his neighbours continue to keep the average standard low. At the same time, all producers should endeavour to improve the quality of their copra, since a good product is easily obtainable at the inconsiderable expense of slight alterations to kilns and process. If such a progressive attitude is generally adopted, and a general improvement in quality results, a favourable price discrimination in Europe may reasonably be expected.

* *Malayan Agricultural Journal*, February 1930, Grist, D. H.

THE REMOVAL OF PLANT NUTRIENTS IN COCONUT CULTIVATION

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Introductory.

The investigation regarding the amounts of plant nutrients removed from the soil by oil palms under cultivation, an account of which was published in this Journal (1), has been extended to coconuts.

Although, as pointed out in that article, chemical analysis of a plant cannot solely be relied upon as an accurate guide to its requirements from the point of view of nutrients, the additional work was carried out in order to have on record comparative figure for coconuts, especially as manuring experiments with both crops are in progress. In this connection, attention is drawn to the article compiled from Departmental records and published in this Journal (2).

Further, it is considered that the results are of special interest in view of the fact that the soils on the estates selected all belong to the heavy coastal type and are relatively rich in plant nutrients, compared with, for example, the light coconut soils of Ceylon or South India. The figures should therefore give some indication of the order of the amounts of the plant nutrients that are likely to be removed under good soil conditions.

Collection and Analysis of Samples.

Samples of leaves, inflorescences and nuts were collected from 6 estates on the West Coast. The palms, from which the constituents were selected, were mature, varying in age from 16 to 30 years.

With regard to the actual constituents, fully developed leaves were taken; that is to say, the lowest hanging green leaf on a palm was cut. In this connection it may be mentioned that owing to the difficulty of severing the leaf close to the trunk, the proportion of midrib may be slightly on the low side; it is not considered, however, that the error is sufficient to alter appreciably the figures given for the average composition of a leaf.

The inflorescences selected were those on which one or possibly two ripe nuts were still hanging, while only ripe nuts were taken for analysis.

Owing to the impossibility of direct sampling, the particular constituent of the palm was separated into its component parts prior to analysis, the proportions of the components being also determined in order to enable the composition of the original constituent to be calculated.

The following table shows the details of separation in each case:—

Palm Constituent.

Leaf
Inflorescence
Nut

Components.

Petiole, Leaflet.
Spathe, Spadix.
Husk, Shell, Meat, Milk.

As regards the analysis of the components, determinations of moisture, nitrogen, phosphate, potash, calcium and magnesium were made, the last two elements being added in view of the important part which they are considered to play in plant growth.

Owing to the large number of separate estimations involved, an attempt was made to accelerate the rate of working by the substitution of volumetric and colorimetric methods for the more laborious gravimetric processes. Such methods were considered sufficiently accurate for the purpose of the investigation, especially in view of the fact that with the relatively small number of samples being analysed, the results could only be relied upon as far as indicating the order of the amount of a particular plant nutrient.

The following is a brief outline of the procedure adopted. In this connection it may be mentioned that the methods to be described for the mineral constituents are those which have been elaborated in the Soils Division of the Department for use in such analyses:—

- (a) Moisture was determined by drying to constant weight at 100°C.
- (b) Nitrogen was estimated by the Kjeldahl method.
- (c) Phosphate was determined by the modification of the Denigès method described in this Journal (3). Occasional checks were made by the usual gravimetric method with good results.
- (d) Potassium was determined by the sodium cobalti-nitrite method described in this Journal (4)
- (e) Calcium was precipitated as oxalate from the solution of the ash in hydrochloric acid after removal of silica, iron and aluminium by appropriate methods. The calcium oxalate was filtered off, treated with dilute sulphuric acid and the oxalic acid titrated with standard potassium permanganate.
- (f) The filtrate from the calcium oxalate was used for the determination of magnesium. The solution was treated with sodium ammonium phosphate (microcosmic salt), the precipitate filtered off and treated with acetic acid in which the magnesium phosphate complex is soluble. The phosphate content of the acid solution was estimated according to the modification of the Denigès method referred to previously, the amount of magnesium being calculated from the amount of phosphate

Results of Analysis.

The results of analysis of the various components and the calculated composition of the constituents of the palms are shown in Tables I, II and III on pages 360 and 361. In order to make the Tables as concise as possible only the average, maximum and minimum figures are given.

In this connection it may be mentioned that the results are based on the analysis of 6 samples of leaves, 7 samples of inflorescences and 8 samples of nuts.

TABLE I.

Analysis of Component Parts and Calculated Composition of Leaves.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Petiole.	Nitrogen	0.097	0.127	0.066
Proportion of Leaf	Phosphate as P_2O_5	0.095	0.194	0.047
64.3 per cent.	Potash as K_2O	0.318	0.639	0.151
Average moisture content	Calcium as CaO	0.130	0.223	0.022
68.1 per cent.	Magnesium as MgO	0.162	0.245	0.033
Leaflet.	Nitrogen	0.596	0.778	0.508
Proportion of Leaf	Phosphate as P_2O_5	0.134	0.162	0.115
35.7 per cent.	Potash as K_2O	0.286	0.487	0.123
Average moisture content	Calcium as CaO	0.094	0.150	0.036
49.8 per cent.	Magnesium as MgO	0.187	0.414	0.024
Leaf. (calculated)	Nitrogen	0.275	0.359	0.224
Average moisture content	Phosphate as P_2O_5	0.109	0.183	0.071
61.6 per cent.	Potash as K_2O	0.297	0.584	0.140
	Calcium as CaO	0.117	0.197	0.027
	Magnesium as MgO	0.181	0.305	0.030

TABLE II.

Analysis of Component Parts and Calculated Composition of Inflorescences.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Spathc.	Nitrogen	0.140	0.168	0.112
Proportion of Inflorescence	Phosphate as P_2O_5	0.082	0.104	0.060
51.3 per cent.	Potash as K_2O	0.828	1.233	0.547
Average moisture content	Calcium as CaO	0.041	0.074	0.024
63.7 per cent.	Magnesium as MgO	0.157	0.251	0.064
Spadix.	Nitrogen	0.249	0.276	0.226
Proportion of Inflorescence	Phosphate as P_2O_5	0.084	0.104	0.050
48.7 per cent.	Potash as K_2O	1.113	1.574	0.748
Average moisture content	Calcium as CaO	0.067	0.117	0.027
59.4 per cent.	Magnesium as MgO	0.169	0.196	0.133
Inflorescence. (calculated)	Nitrogen	0.193	0.211	0.169
Average moisture content	Phosphate as P_2O_5	0.083	0.104	0.055
61.6 per cent.	Potash as K_2O	0.967	1.399	0.645
	Calcium as CaO	0.054	0.095	0.025
	Magnesium as MgO	0.163	0.224	0.098

TABLE III.

Analysis of Component Parts and Calculated Composition of Nuts.

(Results expressed in parts per cent.)

Details	Nutrient	Average	Maximum	Minimum
Husk.	Nitrogen	0.193	0.220	0.153
Proportion of nut	Phosphate as P_2O_5	0.092	0.105	0.074
31.7 per cent.	Potash as K_2O	1.241	1.471	1.005
Average moisture content	Calcium as CaO	0.043	0.081	0.026
31.0 per cent.	Magnesium as MgO	0.113	0.167	0.070
Shell.	Nitrogen	0.081	0.090	0.073
Proportion of nut	Phosphate as P_2O_5	0.035	0.042	0.026
16.5 per cent.	Potash as K_2O	0.364	0.479	0.277
Average moisture content	Calcium as CaO	0.009	0.013	0.006
20.2 per cent.	Magnesium as MgO	0.014	0.025	0.008
Meat.	Nitrogen	0.639	0.693	0.566
Proportion of nut	Phosphate as P_2O_5	0.257	0.300	0.221
29.2 per cent.	Potash as K_2O	0.488	0.605	0.434
Average moisture content	Calcium as CaO	0.002	0.003	0.001
49.3 per cent.	Magnesium as MgO	0.012	0.016	0.007
Milk.	Nitrogen	0.016	0.024	0.010
Proportion of nut	Phosphate as P_2O_5	0.024	0.029	0.021
22.6 per cent.	Potash as K_2O	0.265	0.321	0.214
	Calcium as CaO	0.010	0.019	0.003
	Magnesium as MgO	0.015	0.029	0.009
Nut. (calculated)	Nitrogen	0.265	0.292	0.228
Average moisture content	Phosphate as P_2O_5	0.115	0.134	0.097
49.3 per cent.	Potash as K_2O	0.656	0.795	0.539
	Calcium as CaO	0.018	0.033	0.010
	Magnesium as MgO	0.045	0.068	0.028

Interpretation of Results.

In order to utilise the figures and to form some idea of the total amount of plant nutrients removed during the course of a year it is necessary to know the weights of the fresh constituents for that period. These will naturally vary, being dependent, for example, on the planting distance, the yield of nuts.

Although no definite figures can be laid down, an example, based on average estate records, kindly supplied by the Economic Botanist, is given below in order to afford an indication of the total amount of plant nutrients in question.

Age of palms	Mature (16 to 30 years)
Number per acre	50
<i>Leaves.</i>	
Number removed during year	14
Average weight	17 lbs.
<i>Inflorescences.</i>	
Number removed during year	12
Average weight	2 lbs.
<i>Nuts.</i>	
Number harvested during year	60
Average weight	4 lbs.

Combining the above amounts of fresh constituents with the results of their analysis given previously the limits of the amounts of plant nutrients removed during one year would be as shown in Table IV.

TABLE IV.

Limits of Amounts of Plant Nutrients Removed per Acre per Annum.
(Mature palms planted 50 per acre.)

Details	Nutrient	Average lbs.	Maximum lbs.	Minimum lbs.
Leaves	Nitrogen	32.5	42.5	26.5
	Phosphate as P_2O_5	13.0	22.0	8.5
	Potash as K_2O	35.5	69.5	16.5
	Calcium as CaO	14.0	23.5	3.0
	Magnesium as MgO	21.5	36.5	3.5
Inflorescences	Nitrogen	2.5	2.5	2.0
	Phosphate as P_2O_5	1.0	1.0	0.5
	Potash as K_2O	11.5	17.0	7.5
	Calcium as CaO	0.5	1.0	0.5
	Magnesium as MgO	2.0	2.5	1.0
Nuts.	Nitrogen	32.0	35.0	27.5
	Phosphate as P_2O_5	14.0	16.0	11.5
	Potash as K_2O	78.5	95.5	64.5
	Calcium as CaO	2.0	4.0	1.0
	Magnesium as MgO	5.5	8.0	3.5
Total.	Nitrogen	67.0	80.0	56.0
	Phosphate as P_2O_5	28.0	39.0	20.0
	Potash as K_2O	125.5	182.0	88.5
	Calcium as CaO	16.5	28.5	4.5
	Magnesium as MgO	29.0	47.0	8.0

Remarks and Conclusions.

The figures in Table IV show that considerable amounts of plant nutrients are removed annually in the course of estate practice and point therefore to the necessity of returning to the soil as large a proportion as possible of the actual constituents.

In the case of leaves, inflorescences, and in some instances the husks of the nuts, this is achieved to some extent by spreading the material on the ground and allowing it to decompose gradually, the material being occasionally turned into the soil. Although this practice must undoubtedly result in a certain proportion of the mineral constituents becoming available again for the palm it is probable that most of the nitrogen will be lost.

Further, as regards the nuts, the ashes from the kiln in which the shells are used as fuel may be utilised for the sake of their mineral content by spreading the material over the ground.

Even, however, if all these measures are adopted, the application of artificial fertilisers may still be necessary if mature palms are to continue to yield good crops, since it is uncertain to what extent the plant nutrients returned in the debris are conserved in the soil and become again available for the palms.

As pointed out previously (1) it should be realised that manures may be applied for two purposes, either to replace nutrients which are being removed by the crop, thereby maintaining the supply in the soil at a desirable level, or to increase the amount of a nutrient which may originally have been present in the soil in too small a quantity to permit of maximum growth or yield.

Chemical analysis, whether of the soil or plant, cannot be relied upon as an accurate guide to the need for either type of manuring, especially in the latter case. In so far as chemical analysis may be applied as a rough guide, high content of nutrients in the plant, if combined with a low content in the soil, might indicate the need for manures supplying those nutrients, while for the second type of manuring, low content in the plant, if combined with low content in the soil, may—but not necessarily does—indicate the need for addition of nutrients. Only field manurial experiments, such as those to which attention has already been drawn, can decide this point, the figures obtained in this investigation being merely taken as an indication of the amounts that may be required in connection with the application of the fertilisers.

In conclusion, the writers wish to thank the Managers of Batu Kawan Estate, Bukit Tambun; Chersonese Estate, Kuala Kurau; Kuala Perak Estate, Bagan Dato; Torkington Estate, Sabak Bernam; Klanang Estate, Banting; Teluk Merbau Estate, Sepang for their kindness in providing the necessary samples for analysis.

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Review.

Investigations on Coconuts and Coconut Products.

*General Series No. 8 by F. C. Cooke, A.R.C.S., B.Sc., A.M.I. Chem. E.,
published by the Department of Agriculture, S.S. & F.M.S.,
May, 1932, 99 pages, 14 illustrations, price \$1.*

This Bulletin is divided into two parts; the first contains a description of the conditions under which coconuts are grown and copra is prepared in Ceylon, while the second comprises a report on the result of copra research work in Malaya up to June 30th 1931.

It is well known that Ceylon copra is generally of a higher quality than that produced in Malaya. For its best copra, Ceylon receives a price which is 15 per cent. higher than that of Malaya, the difference at present prices being equivalent to \$0.75 per pikul.

In July 1931, the author made a comprehensive tour of the coconut districts of Ceylon with the object of determining the reason for the superiority of the copra produced there; these reasons are made clear in this Bulletin and many valuable measures of improvement in coconut cultivation and the manufacture of copra are indicated. It was found that the Ceylon coconut-growing soils are in almost every instance, lighter and more open than those of typical Malayan coconut land and that their prevailing lie is undulating rather than flat. A table is given shewing the comparison of typical soils in Ceylon, Malaya and the Philippines.

The organised growing of coconuts on an extensive scale in mountain and hilly country between 40 and 50 miles from the sea, is a remarkable feature. The water-table of Ceylon coconut soils is generally either non-existent, or so far down as to be beyond the reach of the roots. A table of comparison of the characteristics of palms on well cultivated land in Ceylon and Malaya discloses the fact of a similarity in results obtained, in spite of the great dissimilarity of the soil conditions. The importance of water movement is emphasized. The author states that "a flat land with a relatively high water table does not appear to provide the best conditions for long life and sustained yields." Experiments with artificially induced water movement on this type of soil in Malaya have shown satisfactory results, as has the practice of irrigation on sand in Ceylon. Two illustrations are given shewing the methods of planting nuts in sandy loam and in clay, which are in general practice in Ceylon. A table comparing yields of nuts obtained under different systems of planting distances, from observations on estates and small-holdings, is given. The author states that on no area visited was clean weeding practised, though grass was kept short on the majority of estates, by cattle grazing, selective weeding and slashing. Common methods of cultivation are detailed. This work, however, was found to have been considerably curtailed and even abandoned on the more open soils, owing to the

need for economy. On account of the open texture of the soils in Ceylon, drainage as practised in Malaya, was only found in exceptional cases, although the majority of estates had shallow aeration trenches of one foot square, dug every two years in alternate rows. Mounding was found to be a common practice on very hilly land where the soil was thin or poor; rock platforms, or even walls of husks being built to retain wash, or artificially added soil, green manures or fertilisers.

The shrubby types of cover crops such as *Tephrosia candida* and *Crotalaria anagyroides* were found to be chiefly favoured. These are cut back at frequent intervals and the plants themselves ploughed in every two years.

Seven pages of the Bulletin are devoted to the subject of manuring practice in Ceylon. The various more popular mixtures of artificial fertilizers are listed and the results of improved yields obtained are shewn in tables. Owing to the slump, the use of expensive artificial manures, except where absolutely essential, was being discontinued, and the author gives detailed descriptions of the methods of cattle manuring, which, owing to the large extent to which cattle are used for transport, is a very popular practice.

Under the heading of 'Copra Production in Ceylon', the author states that, "it is the practice to visit each palm once every two months. Generally one bunch of fallen nuts is picked up and one bunch of nuts is cut." Nuts fall in a green condition from palms growing in the typical open soils of Ceylon. This is the reason for the practice of nut storage, normally for a period of one month, which is practically unknown in Malaya, where fallen nuts are generally brown. The author suggests that the storage of green, fallen nuts in Malaya, wherever they occur, would materially assist towards an improved quality copra.

The Bulletin contains five diagrams of types of Ceylon kilns, with notes on their advantages and disadvantages. The good quality of copra is achieved by careful preparation involving normally, one day's sundrying to prevent subsequent smoke adhesion; irregular nut arrangement on the kilns to a depth of not more than 18 inches: slow drying at the start, then two days hot drying, with finally one day's slow drying at the finish: the use of clean dry shells for firing and the practice of grading. Commercial Ceylon copra No. 1 shows a 2.5 per cent. greater oil content than Straits No. 1 copra.

A chapter is devoted to the financial, commercial and industrial aspects of the industry in Ceylon.

The introduction to the second part of the Bulletin concerned with "Coconuts and Coconut Products in Malaya", emphasises the need to establish a higher standard grade of the product exported from this country.

During 1931 copra exported from the Straits only realized an average price of £13.14.0 per ton in London as against £14.14.0 for that from Ceylon.

General investigations shew that the commercial growing of coconuts in Malaya is limited to "heavy" soils. A manurial scheme has been started whereby it is hoped to obtain evidence of the response to manuring of palms grown on different types of soil.

A chapter is devoted to the problem of copra deterioration, in which it is proved that careless methods of preparation, the inclusion of excessive water in the finished product and the use of badly designed kilns in which the material is exposed to cold draughts, are factors responsible for serious deterioration in quality and losses in quantity, during the period of local marketing and shipment. In a chapter on nut harvesting and storage, it is conclusively proved that the optimum yields of oil and copra are only obtained from wholly brown ripe nuts and that nut storage is only advisable for green nuts where a mixed crop is harvested. The results of experiments in copra drying on both a small and large scale are detailed, from which it is concluded that when careful and prolonged, continuous drying with moving, hot air is practised, a high percentage oil content, with reduced yields of dry grated copra, results. The explanation of this is its slow dehydration and perhaps also decomposition, without discolouration, of the "solids-not-fat". This accounts for the greater oil content of Ceylon copra, where four to five days drying is the custom, as against two to three days drying as generally practised in Malaya.

H D M

MALAYAN COCONUT STATISTICS.

TABLE 1.
Area of Coconuts in Malaya 1930.

	STATE OR TERRITORY.	IMMATURE.			MATURE.			Total (Acres).
		ON HOLDINGS OF		Total Immature area (Acres)	ON HOLDINGS OF		Total Mature area (Acres).	
		Over 100 acres each	Under 100 acres each.		Over 100 acres each	Under 100 acres each		
<i>Federated Malay States.</i>	Perak	11,476	14,196	25,672	37,664	45,604	83,268	108,940
	Selangor	5,398	35,519	40,917	32,429	36,948	69,377	110,294
	Negri Sembilan	155	1,121	1,276	914	3,776	4,690	5,966
	Pahang	256	3,948	4,204	2,456	7,870	10,326	14,530
	Total F.M.S. ...	17,285	54,784	72,069	73,463	94,198	167,661	239,730
<i>Straits Settlements.</i>	Singapore	...	...	...	3,159	4,841	8,000	8,000
	Malacca	...	2,330	2,330	...	10,255	10,255	12,585
	Dindings	893	1,696	2,589	1,764	2,177	3,941	6,530
	Province Wellesley	2,183	1,438	3,621	15,415	17,785	33,200	36,821
	Penang	308	359	667	2,936	9,923	12,859	13,526
	Labuan	...	1,958	1,958	...	1,238	1,238	3,196
	Brunei	...	681	681	...	689	689	1,370
	Christmas Island	...	...	...	...	19	19	19
<i>Unfederated Malay States.</i>	Total S.S. ...	3,384	8,462	11,846	23,274	46,927	70,201	82,047
	Johore	428	32,622	33,050	2,873	129,127	132,000	165,050
	Kedah	361	8,453	8,814	492	17,382	17,874	26,688
	Perlis	...	1,434	1,434	...	2,527	2,527	3,961
	Kelantan	...	...	...	...	...	...	57,271
<i>Grand Total</i>	Trengganu	...	...	...	...	...	...	25,000
	Total U.M.S. ...	...	...	...	...	...	...	271,970
	Malaya	...	...	...	...	...	...	599,747

TABLE 2.

Annual Exports of Copra from the Federated Malay States.

YEAR	PERAK	SELANGOR	NEGRI SEMBILAN	PAHANG	TOTAL F M S
	Tons	Tons	Tons	Tons	Tons
1924	38,545	12,900	1,179	560	53,184
1925	40,007	15,426	2,236	315	57,984
1926	44,542	16,963	3,417	907	65,829
1927	39,499	14,121	3,302	615	57,536
1928	45,451	20,147	2,252	654	68,504
1929	45,897	20,937	1,493	700	69,027
1930	46,647	22,714	1,095	587	71,043
1931	41,259	23,683	202	439	65,583

TABLE 3.

Net Exports Coconuts Products from Malaya.

YEAR	FRESH COCONUTS		COPRA		COCONUT OIL		TOTAL COCONUT PRODUCTS	
	Tons	Value \$	Tons	Value \$	Tons	Value \$	Tons	Value \$
1923	—	374,215	90,606	18,084,568	6,378	2,062,721	—	20,521,504
1924	13,035	413,174	91,734	19,739,483	8,084	2,201,566	110,853	22,354,223
1925	13,202	463,666	86,420	19,074,387	7,673	2,830,943	107,295	22,368,996
1926	10,032	401,378	104,394	21,810,517	8,504	3,113,495	122,930	25,325,309
1927	15,988	655,796	86,504	16,538,385	10,275	3,470,281	112,767	20,664,462
1928	13,479	535,600	95,628	18,669,311	9,884	9,190,439	118,991	22,395,350
1929	10,239	479,345	112,429	19,662,622	8,725	2,507,279	131,393	22,649,246
1930	10,478	406,921	102,014	15,307,511	9,473	2,359,357	121,965	18,073,789
1931	10,468	243,058	100,809	9,677,676	9,909	1,637,591	121,186	11,558,325

Miscellaneous Article.

ENTOMOLOGICAL NOTES.

Second Quarter, 1932.

BY

G. H. CORBETT.

Considerable correspondence has been conducted relating to the control of insects and other pests during the past quarter. The principal enquiries were those relating to

(1). "Cutworms." (*Agrotis ypsilon* Rott.)

"Cutworms" are the caterpillars of moths and are so-called because of their habit of biting through the stems of young plants. The most important cutworm in Malaya is probably the caterpillar of *Agrotis ypsilon* Rott. This insect was reported from Fraser's Hill in March, 1925, damaging the grass of the golf course and from Cameron Highlands in October, 1927, injuring for the most part vegetable plants.

This insect is universally distributed and is an important pest in North America and Europe. "Cutworms" rest in the soil during the day and feed at night. The female moths lay their eggs generally where the ground is well covered with vegetation so that the young caterpillars can readily find food. The life-history has been worked out in the Lowlands; the egg hatches in about 3 days, the caterpillar is full-grown in about 25 days when it enters the ground for pupation and the pupal period lasts about 8 days—a total of about 36 days.

In addition to (1) keeping down weeds, especially sometime before planting takes place (2) hand collection of the caterpillars and (3) protecting plants by surrounding the stems with tins which have the bottoms knocked out, a poison bait has always proved successful in destroying large numbers of "cutworms". The bait, which should be distributed in the late afternoon, is either broadcasted at the rate of 10 lbs. dry weight to the acre about two days before the plants are to be planted out or a tablespoonful is placed near each plant or at every 2 or 3 feet in the row. The bait is composed of 1 lb. Paris Green to 50 lbs. bran with sufficient water to make moist but not sloppy. A cheap syrup which is considered to enhance the attractiveness of the bait is sometimes incorporated.

If available, frames with wire gauze covers will be found satisfactory in protecting such plants as lettuces but would probably be too expensive to be employed on a large scale.

(2). The Coconut Zygaenid (*Artona catoxantha* Hamp.)

The caterpillars of this moth which were received on April 6th. from the Banting area for identification and for advice concerning treatment were reported to extend over an area of some 60 acres of tall coconut palms. The full-grown

caterpillar is about 10 mm. long with a purplish coloured dorsal stripe and with four longitudinal rows of fine hairs.

The occurrence of this pest at this time of the year is unusual and although it has numerous parasites, its disappearance has generally been considered to be due to high winds and heavy rains. Although these conditions have been prevalent, this moth has increased and the appearance of the attacked palms suggests that the leaves have been scorched by fire. Fortunately parasites are generally distributed and will probably prevent the moth becoming widespread.

The control of insects on 60-80 feet palms is rendered difficult since the machinery for spraying or dusting is not available and even if it could be supplied its transport would frequently be impossible owing to the nature of the land. Therefore alternative measures have to be suggested. In this case, grease banding the palms was recommended to prevent the caterpillars which had been blown by wind to the ground re-ascending the palms. This measure was eminently successful in so far that thousands of caterpillars were prevented from returning to the leaves.

The mixture which consisted of 16 lbs. of rosin dissolved in one gallon of castor oil was painted on the palms in rings about 2 inches wide.

The Manager has sent information that this treatment over the 60 acres of palms costs about 77 cents per acre and has supplied the following particulars :—

64 lbs. of Rosin	...	...	...	...	\$25.60
4 gallons Castor oil	...	...	...	...	10.00
Car hire	...	...	...	...	.60
Labour	...	...	...	...	10.05
					<hr/>
					\$46.25
					<hr/>

This mixture remains effective for at least two weeks and if rubbed with a coconut husk which has been steeped in castor oil will be revived.

(3). Coffee Berry Beetle Borer. (*Cryphalus hampel* Ferr.)

The attention of the planting community has on previous occasions been drawn to the danger of this beetle gaining entrance into non-infested areas by the introduction of seeds for planting purposes or beans for consumption from infested areas and an enquiry was received asking for information on this matter.

There is a real danger of introducing this beetle unless the seeds and beans are treated, so rendering them free from this insect.

The market price at present for non-infested good quality beans is \$25 per pikul, but for infested beans \$16 per pikul. It will be seen therefore that a loss of about \$9 per pikul may be attributed to this beetle. It should be emphasised that this loss is continuous and although regular weekly collection of bored green and ripe berries will increase the percentage of unbored ripe berries,



COCONUT PALMS DAMAGED BY THE CATERpillARS
OF *Artona*.

consideration should undoubtedly be given to prevent the formation of berries over a period of some four months. Mr. W. H. Barnes, Agricultural Field Officer, Negri Sembilan, has informed me that an area of coffee which was badly infested with this insect was stripped of all fruits and kept free of berries for a period of six months and all fallen berries collected. About 18 months after stripping he reported that he had examined this area and was unable to find a single case of coffee berry borer attack though the trees were fruiting heavily and ripe coffee was plentiful. This area was not adjacent to other coffee areas.

(4). Mailing Insects.

Enquiries are received concerning insects which on arrival are frequently unrecognizable and the description of the injury or supposed damage to plants so doubtful that in many cases control measures cannot be advanced. To facilitate the work in connection with an enquiry, the following directions should be observed :—

1. Match or cardboard boxes, since they are often broken in transit, should not be used for sending insects. Wooden boxes, especially for long distances, are better than cigarette or biscuit tins. All containers should be ventilated. Glass tubes should not be corked but plugged with cotton wool. A wood borer should be despatched in a ventilated tin box.

2. As many specimens of the insect as possible should be forwarded, though overcrowding should be avoided by employing more packages.

3. Two species of insects should not be placed in the same box since one may live at the expense of the other.

4. All insects and larvae (grubs, maggots, caterpillars etc.) should be sent alive with a supply of food, and after collecting despatched as soon as possible.

5. All packages should be distinctly marked Live Insects and should bear the name and address of the sender.

6. A letter should always accompany the package giving a full account of the nature and extent of the damage, the part or parts, and the name or names of the plants attacked, and the date when first noticed.

Departmental.

FROM THE DISTRICTS.

The Weather.

Rainfall in the central portions of the Peninsula was below the normal for the month, with the exception of Pahang where the fall was average, with heavy precipitation in Bentong District. In Kedah the weather was variable in different districts, being wet in the North during the first week of the month. In Penang and Province Wellesley it was showery with frequent strong winds.

Johore experienced only occasional showers which became more frequent towards the end of the month, while in Singapore the weather was wet.

Remarks on Crops.

Rubber.—Prices for small-holder's rubber showed a decrease on those of the previous month, and ranged in dollars per pikul from \$3 to \$7 for smoked sheet and from \$2.75 to \$5.50 for unsmoked sheet. The areas out of tapping among small-holdings had further increased. It is probable that in many districts this increase was only due to the absorption of all available labour in work in the padi fields. The Agricultural Field Officer, Penang and Province Wellesley, alone reports that no new untapped areas have been observed in his district during the month. The occasional cutting out of small areas of rubber with the object of planting food crops was reported as continuing in almost all districts.

The position with regard to mouldy rot remains unchanged: sporadic outbreaks have occurred in Province Wellesley and Johore with the advent of damp weather.

Padi.—Throughout the Peninsula, many new padi areas are reported to be in preparation this season. Work in the fields was in various stages of progress and was being carried out with unusual thoroughness.

Planting was in progress or completed in Selangor, Negri Sembilan, with the exception of Kuala Pilah District and Pahang.

Preliminary clearing was carried out in North Kedah, Province Wellesley and Perak; the work was somewhat more advanced in Johore, where in some areas transplanting had begun. In most parts of Malacca and in Kedah South, the work was delayed by draught.

The area under ~~wet~~ padi in Johore has increased by 3,592 acres since 1931 and that under dry padi by 1,036 acres.

The work of rat destruction is reported throughout to be progressing satisfactorily. The few outbreaks of insect pests observed have been of minor importance.

There ~~has been~~ a moderate distribution of pedigree strain*seed in all States during the month; in Malacca the total amount distributed to the end of June was 2,610 gantangs. In part of Kuala Pilah District of Negri Sembilan the

long-season padi Seraup Kechil No. 36 has been in demand, while in Perak South preference has been shown for short-season strains with the object of obtaining two crops per year.

In the Dindings padi planters in two localities are co-operating under the guidance and advice of the Penghulu and the Malay Agricultural Assistant in the construction of bunds to keep out sea water which severely damaged their padi in the past season. They assemble about once a week for this work and have made satisfactory progress. The provision of the necessary water-gates was considered at meetings organised by the Malay Agricultural Assistant.

Coconuts.—An increasing interest in the cultivation of this crop and in the improvement of manufacture of copra has been evinced in most districts. This was particularly noticeable in Selangor and Lower Perak where several new and improved types of kiln have been erected in accordance with departmental instructions.

In Kuala Selangor the manuring of palms by native cultivators has been observed. New plantings of this crop have been reported to replace felled rubber trees. Crops generally have been good during the month. The report from Malacca states that the local market for nuts is poor. As many Chinese kilns have stopped the preparation of copra, there has been a small export of nuts from the Settlement.

Prices for copra have ranged between \$3 and \$5 per pikul.

Tobacco.—Kedah and Johore are the only States which report a slight increase in areas under tobacco.

A decline in its cultivation owing to the fall in price, is reported in Perak, Selangor and Province Wellesley.

A good crop was grown and cured at the Alor Star Vagrants' Camp in Kedah and was supplied to the inmates.

Prices for cured leaf have ranged between \$10 and \$30 per pikul in the above-mentioned States. In Pahang, however, the price range for locally prepared tobacco has been from \$48 to \$144, in Negrì Sembilan \$40 to \$90 and in Johore \$35 to \$80.

Tea.—The gardens at Sungei Balak in Selangor have made considerable headway, combined with improvement in pruning and cultivation methods. On Cameron Highlands Experimental Plantation there are now 44½ acres under this crop. The tea "flushed" well during the latter part of the month. It was found that by plucking leaf at intervals of eight days the made tea had a better appearance. The crop harvested during the month was 1,959 lbs. of green leaf, approximating to 245 lbs. of made tea per acre per annum.

Pineapples.—In Johore and in Selangor, the area under this crop has been extended. A Chinese pineapple grower in Kuala Langat has planted up a further area of 250 acres. Good crops have been harvested during the month.

In Singapore the fruit packers complained that fruit supplied recently has been small and unsuitable. They stated that fruit from plants over five years old is useless for canning. In this connection it should be remembered that it

is not at present the usual practice to manure this crop.

Fruit.—In most parts of the Peninsula heavy crops of durian and mangosteen were harvested and rambutan had commenced to ripen.

In Province Wellesley there was a glut of the two former fruits which were selling at 3 to 4 cents each and 8 cents per 100 respectively: some of the surplus was exported to other States and to neighbouring countries. In Kedah these fruits were only beginning to appear on the markets, while in Negri Sembilan the durian crop was disappointing, except in Rembau district, and mangosteens and rambutans were only beginning to ripen.

In Johore durians were selling for 3 to 4 cents each and mangosteens for 30 cents per 500 in the villages, although the retail prices in the markets of Singapore and Johore Bahru are reported to have been 7 to 10 cents per kati for durians and 6 to 8 cents for 10 mangosteens.

Maize.—In Kedah the harvesting of maize was in progress and a large quantity of ears exposed for sale in the local markets and weekly fairs indicated unusual attention to this useful crop.

Weekly Fairs.

Village fairs are reported generally to have continued to serve a useful purpose. In Selangor alone fairs have been started in eight new centres, all of which have been well patronized. In places the prices obtained for produce have been higher than those of the local shops. A point of interest at the fairs in Kedah was the active business done in the sale of ploughs and other implements for padi cultivation. This is not only a novel feature in itself but an indication of a further gratifying extension in the area that will be planted with wet padi in the State this season.

Agricultural Stations and Padi Test Plots.

NEGRI SEMBILAN.—The work of jungle felling has been completed at the new Kuala Pilah Agricultural Station and root extraction was begun. Each area was banded and planted with leguminous cover crops as soon as it was cleared.

MALACCA.—A solar propagator for the rooting of cuttings was erected at the Sungei Udang Station.

The water-pumping plant at Pulau Gadong Padi Test Plot proved itself invaluable during the month, as without it the deficiency of rain would have prevented the preparation of the land and the sowing of the nurseries. It ran for a total of 15 hours.

Crops of ground nuts have been harvested on the Kuala Kangsar and Kuala Lipis Agricultural Stations, where the yield at the former was 1,100 lbs. per acre.

General routine work has progressed very satisfactorily at all the other Stations.

DEPARTMENTAL NOTES.

Tour of Director of Agriculture.

The Director of Agriculture made a visit of inspection of the Dairy Farm, Fraser's Hill on 2nd. and 3rd. June, 1932.

Inter-Departmental Agricultural Conference, 1932.

It is proposed to hold an Inter-Departmental Agricultural Conference at Kuala Lumpur from 2nd to 6th August, 1932. The Conference will thus directly follow the Malayan Exhibition to be held at Kuala Lumpur on July 30th and 31st and August 1st.

Two successful agricultural conferences have been held in Kuala Lumpur in 1929 and 1930. The coming Conference, however, is conceived on rather different lines from its forerunners and is intended to deal with the agricultural proprietary owners and occupiers.

The object is to examine existing agricultural industries, other than rubber, with a view to ascertaining the present position, the immediate outlook and possible improvements and the means of introducing such improvements, using as far as possible existing machinery and resources. It is also intended to endeavour to ascertain what, if any, new industries can be introduced and what industries at present existing on a restricted scale can be extended with the idea of lessening the dependence of this country on imported staples.

Memoranda are being drawn up containing, in a concise form, information of the present statistical position, condition of cultivation and the chief directions in which improvements are possible of crops grown in Malaya.

At the Conference the memoranda will be discussed and resolutions framed summarising the main conclusions arrived at.

The Conference will also discuss the general economics of peasant agriculture with special reference to grading and marketing peasant produce and the finance of peasant agriculture. Chinese agriculture may also find a place in the discussion.

Other questions to be treated, if time permits, are livestock policy, particularly in relation to the supply of poultry, eggs and meat; agricultural work in the schools, prize-holding schemes, shows and the like.

The desirability of devoting one session of the Conference to land questions in relation to the various crops considered will also be kept in view.

The Conference is to be regarded not merely as 'an agricultural officers' conference, but as an inter-departmental gathering, the field of which covers the whole field of Malayan agriculture in relation to smaller proprietary holdings, excluding rubber.

Coconuts in Lower Perak.

As reported in these notes last month, the Assistant Chemist for Copra Investigations made a tour through the coconut plantations—large and small—in the Lower Perak District between May 22nd. and 28th.

His report on this visit is now to hand and contains remarks and criticisms

which should be of considerable value to copra producers in general, and to those of Lower Perak in particular.

The report states that although the grade and moisture content of copra exports from the district are normal, and insects and moulds practically absent, the worst features are smoke and red colouration of the product.

Careful harvesting is now being practised in nearly all the estates. Fewer estates are using water transport of nuts to factory, while a great number are splitting the nuts in the field. When delay occurs, this change has resulted in deterioration of quality.

With few exceptions, kilns are seriously overloaded and a half nut arrangement face downwards is causing serious deterioration.

In certain instances, extremely muddy conditions were found in the splitting yards.

Kiln Design. Every kiln had its own characteristics and with two exceptions only, they all required minor or major alteration to ensure uniform conditions of drying.

Generally, an excessive number of ventilation holes was provided, smoke escape was too liberal and cold draughts were allowed to play on the copra.

If better draught protection is provided, it will be necessary to have a jack roof fitted or to open up the roof near the ridge to provide top ventilation so as to avoid stagnation. Partition walls in the fire pit were absent in all cases.

In certain instances, kilns were not erected against the prevailing wind and on the sea front this is a very serious fault.

In a few cases, a shell fuel store was provided in the kiln verendah, in all other cases no special care was taken to keep the fuel dry and in one instance the fuel was actually stored in the path of roof water.

Number of Kilns. Yields have in most cases increased without corresponding increase in kiln accommodation with the result that in many cases the kilns are permanently overloaded, while in practically all cases, there is no provision for bumper harvests.

The correct normal load per square foot is $\frac{N}{10}$ where N = number of nuts per picul. Normal loads recorded were 39, 25, 42, 33, 20, 41, 30, 25, 29, 33, 25, 33, 33. The correct load for this district is 25 nuts per square foot or less.

Leave.

Mr. B. Bunting, Agriculturist, has been granted 7 months and 12 days leave on full pay with effect from 11th June, 1932.

Mr. J. N. Milsum, Assistant Agriculturist, returned from leave of absence on 9th June, 1932.

Retirement.

Mr. C. M. Maggs, Horticultural Assistant, has been granted 2 months and 2 days leave on full pay from 11th June, 1932.

Owing to ill-health, Mr. Maggs has been medically boarded out of the service.

MEETING OF THE AGRICULTURAL ADVISORY COMMITTEE HELD ON MAY 26th 1932.

A meeting of the Agricultural Advisory Committee was held on May 26th, 1932, at which the following members were present :—

Director of Agriculture - - Dr. H. A. Tempany (*Chairman*).

Director of Co-operation - - Mr. A. Cavendish.

Ag. Director, R.R.I. - - Mr. A. Sharples.

Messrs G. S. Reis, W. A. Stanton, C. B. Towill and the Chief Research Officer (Secretary).

The Chairman welcomed Mr. Towill to the Committee and announced with regret the resignations of Messrs. Egmont-Hake and Kennaway. He explained that he had not called a meeting of the Committee in the first quarter of the year as he desired on his return from leave fully to acquaint himself with the progress of work in the Department before doing so.

At the meeting various subjects were discussed, these included.—

Padi. The Committee was informed that tests on the culinary qualities of 12 different selected varieties of strains of padi had been carried out in 9 places. The tests were based on opinions recorded on cooked samples of each by a number of Malays and other habitual rice eaters. The tests showed that a few of the varieties were popular in every centre and that a few were equally unpopular. Further tests with a smaller number of varieties which are known to be heavy yielders are being arranged.

The question was discussed of the possibility of using the 'floating padis' of Indo-China for cultivation in Malaya in districts liable to flooding; it was pointed out that floods in Malaya are usually of short duration and that when they occur the water usually runs very rapidly; in such circumstances it seemed unlikely that floating padis will be useful.

The meeting was informed that specimens of high yielding Italian padi collected by the Chairman while on a visit to the Italian rice fields had been tried out and had not so far proved successful. A small quantity of seed from the plants sown at Malacca had been collected and would be planted in the coming season in the endeavour to acclimatise these varieties.

Coconuts. The Committee was informed that up to the present it had not been possible to inaugurate the projected series of manurial experiments on young coconut palms owing to shortage of funds consequent on the financial stringency. It was, however, hoped that it might be possible to start an experiment in the near future.

The Committee was informed that Messrs Cooke, Assistant Chemist, Copra Research and Simpson, Agricultural Field Officer, Selangor, had written an interesting report on attempts made by them to improve the quality of copra produced by small-holders in the District of Kuala Selangor. Their work had shown that it was easily possible for small-holders to construct satisfactory

small kilns for a very low cost in which with care copra of good quality could be produced. The copra capable of being produced in such kilns, although below Ceylon No. 1 quality, is definitely much above the present average of Malayan small-holder's copra, whether prepared by the Chinese middleman or by the small grower himself.

The meeting was informed that experiments on the control of epiphytic growths on oil palms and coconuts by spraying with common salt or with sodium chlorate had been in progress in Kuala Lumpur for some time past. The results had not been encouraging so far. Further experiments were in contemplation with a view to ascertaining whether epiphytics were in any degree harmful to trees. A member pointed out that he believed that some years ago some experiments on the latter point had been conducted on a coconut estate and that so far as his recollection went, it was found that epiphytes did not harm coconut palms.

Oil Palms. In continuation of discussions at previous meetings, the Committee further considered the question of the control of rats by means of virus. It was pointed out that the Director, Institute for Medical Research, estimated that a sum of \$10,000 would be required to carry out an investigation extending over two years into the possibility of obtaining an efficient local virus. The Committee was informed that in the opinion of the Chairman and his technical officers, the expenditure of this sum would be of doubtful utility as it seemed improbable that the work would lead to results of lasting value. It appeared that even if a virulent virus was isolated it was probable that immunity would be acquired by rats in due course and this would rapidly render the work ineffective. It was agreed that while it was obviously desirable to explore every avenue which might assist in securing rat control, the present financial stringency, combined with uncertainty whether lasting and effective results could possibly follow work along these lines, did not permit a recommendation to be made to Government that it was available to incur the suggested expenditure.

In connection with rat control the question of the action of Government in discontinuing the grant of pack licences for estate dogs was raised. In the opinion of the Committee organised rat hunts with packs of dogs are an exceedingly valuable method of rat control on oil palm estates.

Dairy Farm at Fraser's Hill. In connection with certain queries as to the Dairy Farm at Fraser's Hill deferred from the preceding meeting, the Committee was informed that the milk of the Freisian herd at Fraser's Hill was thoroughly satisfactory in quality. The average fat content was well over 4 per cent. as compared with the English legal requirements of 3 per cent. The principal reason why the importation of Freisian cattle had been decided upon was that experience in various parts of the tropics had shown that this breed could be acclimatised with greater ease than any other and gave higher yields. The results at Fraser's Hill so far had been excellent both as regards yield of milk and health of animals. Surplus young stock from the herd was sold off as available.

Fertilisers Enactment. The Committee was informed that after extensive consideration of the projected Fertilisers Enactment by the Governments and by commercial and planting interests, it had been decided, in view of the present financial situation, that it was inadvisable to proceed with the legislation for the present.

Soil Erosion. The Committee considered further the question of measures to prevent soil loss when opening up areas in the central highlands. The question had been dealt with on previous occasions, while the report of the Ceylon Committee on the prevention of erosion had been circulated among members.

The question as to the maximum slope which it was desirable to allow to be deforested in the interests of the prevention of erosion was discussed. In Ceylon the limit had been fixed at 45°.

The Chairman read to the meeting a summary prepared by the Chief Field Officer in which were described certain recent investigations on the subject which had been undertaken by the Field Branch of the Department of Agriculture in collaboration with the Forest Department. As the result of the investigation it had been possible to make certain recommendations to Government. The main feature of these recommendations was that 40° should be regarded as the extreme limit of steepness of slopes which could be deforested without risk of serious loss and damage and that large areas on which the slope exceeded 40° should not be cleared. Small areas having a slope in excess of 40° and which being contained in a larger area of lesser slope did not reveal themselves before clearing should immediately be allowed to grow up again in blukar and should not be planted with tea or other commercial crops. From the reports of inspecting officers it did not appear that this limitation would exclude from cultivation any great areas of land which would otherwise be cultivated at Cameron Highlands or its environs.

Giant Snails. In reply to an enquiry the Chairman stated the giant snail could undoubtedly cause considerable damage in gardens and some forms of cultivation, but that in the opinion of the Department it should be controlled by keeping down long grass, avoiding rubbish heaps etc. which served as breeding places for the snail; an attempt had been made recently with the co-operation of the Selangor Gardening Society to stimulate interest in the systematic destruction of the snail. It is considered that provided proper vigilance is exercised, the snails should not be a greater menace to vegetable gardeners than they are to flower gardeners; the large size of the pest renders it comparatively easy to control. A promise was given to the Committee that propaganda would be undertaken with a view to stimulating efforts for the destruction of the pest.

Subjects discussed additional to the above comprised the Chairman's memorandum to the Retrenchment Commission on reduction in expenditure in the Department, potato cultivation at Cameron Highlands, the effect of cover crops and grasses on crops, the position of tobacco cultivation, the import of fodders in Malaya and Departmental officers' reports.

Statistical. MARKET PRICES.

June, 1932.

Rubber.—The average June spot price of rubber smoked sheet equal to London Standard was 4.95 cents per lb. in Singapore, 2.64 cents (Gold) New York and 1.72d. London, as compared with 5.39 cents Singapore, 3.04 cents (Gold) New York and 1.81d. London in May. The Singapore price during June varied from 4 13/16 to 5 1/16 per lb.

Palm Oil.—The following are the quotations received in Kuala Lumpur weekly in June for palm oil c.i.f. Liverpool on a basis of 18 per cent. f.f.a.—1st. £15, 8th. £14.10s., 15th. £14, 22nd. £15, 29th. £14.10s. The market closes easy.

Palm kernels were quoted at £9.10s. on June 2nd.

Copra.—Market improved slightly during the month, though the average price is less than that of May. The Straits Homeward Conference has reduced the rate of freight to 30s. per 12 cwt., following this with an announcement that a contract had been entered into with Unilevers Ltd. whereby all their copra for Europe is taken at the nett basis rate of 27s. per 12 cwt.

The Singapore average price of Sundried in June was \$5.17 per picul as compared with \$5.48 in May, while the average June quotation for Mixed was \$4.72 as compared with \$4.92 in the previous month.

Copra cake average \$1.78 per picul in June.

Coffee.—June prices shew some decline over those ruling in May. Palam-bang coffee averaged \$16.87 per picul as compared with \$18.54 in May. Sourabaya coffee averaged from \$20.94 to \$22.87, the price within this range depending upon quality.

Areca nuts.—Palambang averaged \$2.77 per picul and Bila Whole \$2.90 per picul in June as compared with \$2.75 and \$2.87 respectively in May. Average prices per picul in June for other grades were:—Split \$3.56 to \$5.19, Red Whole \$6.50 to \$7.50, Sliced \$9.62 to \$12.81, Kelantan Split \$5.01 to \$5.41, the price within each range depending upon quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during May 1932:—Siam No. 2 Ordinary \$3.77, Rangoon No. 1 \$3.86, Saigon No. 1 \$3.92 as compared with \$3.82, \$3.89 and \$4.01 respectively in April.

The average retail market prices in cents per gantang of No. 2 Siam rice in May were:—Singapore 29, Penang 37, Malacca 29, corresponding prices in April being 31, 38 and 30.

Gambier.—Cube No. 1 dropped from \$16 to \$13 per picul, the average for June being \$14.70 as compared with \$16.62 in May. Block gambier has varied from \$7.50 to \$8 per picul, the average for June being \$7.70 as compared with \$7.69 in the previous month.

Pineapples.—Canners' schedule of prices has been discarded and prices have

slumped badly. Unseasonable weather in England, with virtual closing of the Canadian market and a large "pack", combined with the reduced buying power of the world, are stated to be the causes of the break. Average prices per case in Singapore during June were:— $1\frac{1}{2}$ lb. cubes \$3.27, $1\frac{1}{2}$ lb. sliced flat \$3.15, $1\frac{1}{2}$ lb. sliced tall \$3.32 as compared with \$3.50, \$3.30 and \$3.50 respectively in May.

Tapioca.—Prices remained steady until the end of the month when both flake and pearl medium sagged. Average prices per picul in Singapore during June were:—Flake fair \$3.37, Pearl, seed \$3.80 and Pearl, medium \$4.20. Corresponding prices in May were \$3.00, \$3.80 and \$4.25.

Sago.—Prices fairly steady. Pearl, small fair averaged \$4.30 per picul in June, as compared with \$4.25 in May; Flour, Sarawak fair averaged \$1.93 per picul as compared with \$2.04 in May.

Mace and Nutmegs.—Siouw mace has appreciated in value, while Amboina shewed a decline at the end of the month. Average Singapore June prices per picul were; Siouw \$52.60 as compared with an average of \$61 per picul in May, Amboina \$37.40 per picul in June as compared with \$44 in May.

The better quality nutmegs improved in value during the month, while the cheaper grade shewed some decline. 80's averaged \$27.90 per picul in Singapore as compared with \$27.25 in May; 100's averaged \$23.50 in June as compared with \$24 per picul in the previous month.

Pepper.—The demand has been easily satisfied by the new crop coming forward. Prices have shewn some improvement during the month. Singapore average prices per picul in June were:—Singapore black \$18.30, Singapore white \$22.70, Muntok white \$23.50 as compared with \$18.56, \$22.25 and \$22.75 in May.

Cloves.—Prices have been generally nominal, but during the latter part of June shewed a downward tendency. Average quotations per picul in June were:—Zanzibar \$44 per picul as compared with \$47 in May; Amboina \$47.80 per picul as compared with \$50 in May.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Weekly Reports published in June. Palm oil reports are kindly supplied by Messrs. Cumberbatch and Co., Ltd., Kuala Lumpur, and reports on the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57 Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

May, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during May, 1932, amounted to 38,225 tons as compared with 58,849 tons in May, 1931, of which 48.2 per cent. were consigned to Singapore, 17.8 per cent. to Penang, 8.0 per cent. to Malacca, 22.9 per cent. to the Federated Malay States, and 3.1 per cent. to the Unfederated Malay States.

Of these imports 60.3 per cent. were from Siam, 38.2 per cent. from Burma, 0.5 per cent. from French Indo-China and 1 per cent. from other countries.

Total foreign exports of rice in May, 1932, were 12,557 tons (including 105 tons domestic production, exported from Penang) as compared with 13,285 tons in May, 1931. Of these exports 88 per cent. went to Netherlands India and 12 per cent. to other countries.

Net Imports for the period January to May, 1932, were 165,207 tons as compared with 221,436 tons for the same period of 1931, a fall of 25.4 per cent.

Malayan padi reports indicate that work for the season 1931—32 is in hand in all areas. Harvesting has been completed in Perak, Pahang, Malacca, Province Wellesley, Penang and Kedah. It is in progress in the Dindings, where prospects are reported to be poor.

India.—Total foreign exports of Rice (*Indian Trade Journal* 26.5.32) during March, 1932, were 357,000 tons as compared with 241,000 in February, 1932 and 264,000 tons in March, 1931, increases of 48.2 per cent. in respect of the previous month and 35.2 per cent. in respect of the same period of the previous year.

Total exports of rice and bran from Burma for the period January 1 to April 30, 1932, amounted to 1,374,727 tons as compared with 1,405,078 tons for the corresponding period of 1931, or a decrease of 2.2 per cent.

Of these exports 336,030 tons went to India in 1932 as compared with 599,343 tons in 1931, a decrease of 43.9 per cent.

Siam.—The *Bangkok Times* of May 25, 1932, states that by the report on the padi crop for the year 1931—32, in the seven main exporting circles, the area under padi was 4,487,524 acres, a drop of 136,212 acres or 2.94 per cent. as compared with 1930—31. It was even 27,800 acres less than in 1929—30, but more than in any year before that. The damaged area was 906,604 acres as compared with 542,240 acres a year ago, being 20.2 per cent. and 11.7 per cent., respectively, of the planted area. The area harvested was 3,580,920 acres, which is 500,500 acres less than the previous year and the yield was 2,276,520 tons, being 313,500 tons less than in 1930—31.

Exports of rice from Bangkok during April 1932 amounted to 113,555 tons as compared with 116,281 tons in April 1931 or a decrease of 2.3 per cent.

* Abridged from the Rice Summary for May 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Exports of rice from Bangkok during the period December 1931 to April 1932 amounted to 611,984 tons an increase of 88,490 tons or 16.9 per cent. as compared with the same period of 1930—31.

Japan: Formosa.—*The International Crop Report*, Rome, for April, 1932, states that cold weather late in February slightly checked the growth of rice of the first crop in seedling beds, but no great damage was noticeable. Growth in March was normal. Transplanting was started in the North, while it was almost finished in the Central and Southern parts of the island.

Netherlands India: Java and Madura.—*The Korte Berichten* states that at the end of April, 1932, the area harvested amounted to 2,640,750 acres, an increase of 40,250 acres or 1.5 per cent. as compared with the same period of 1931, the area damaged to 77,789 acres a decrease of 16,805 acres or 17.8 per cent. as compared with 1931, and additional plantings awaiting harvest to 5,587,750 acres an increase of 87,500 acres as compared with 1931, a total of 8,306,289 acres as compared with 8,195,344 acres for the same period of 1931, an increase of 1.4 per cent.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.23 to 31.5.32 amounted to 550,092 (metric) tons, an increase of 65,955 tons or 13.6 per cent.

Exports of rice from Saigon for the period 1.1.32 to 31.5.23 amounted to 533,172 (metric) tons an increase of 106,103 tons or 24.8 per cent. as compared with the same period of 1931.

The International Institute of Agriculture, April, 1932, states that in Indo-China the latest estimate places the total production at a possible maximum of 5,625,000 tons of padi.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe, period January 1 to May 12, 1932, 402,912 tons as compared with 352,067 tons for the same period of 1931, an increase of 14.4 per cent.

Of the 1932 shipments 62.9 per cent. was from Burma, Nil from Japan, 29.5 per cent. from Saigon, 2.3 per cent. from Siam and 5.3 per cent. from Bengal, as compared with 67.7 per cent. from Burma, 3.8 per cent. from Japan, 16.9 per cent. from Saigon, 6.4 per cent. from Siam and 5.2 per cent. from Bengal in 1931.

- (b) To the Levant, period January 1 to April 7, 1932, 31,261 tons, an increase of 16,921 tons or 118.0 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to April 2, 1932, 53,009 tons, an increase of 4,922 tons or 10.2 per cent. as compared with the same period of 1931.

Erratum.

Malayan Agricultural Journal for June 1932, page 323, line 2, for "46.6 per cent." read "64.6 per cent."

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF APRIL, 1932.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING				Total (3) + (5)	Percentage of (7) to (2)
		Percentage of		Percentage of		Percentage of		Percentage of			
		Acreage (3)	(3) to (2) (4)	Acreage (5)	(5) to (2) (6)	Acreage (5)	(5) to (2) (6)	Acreage (5)	(5) to (2) (6)		
(1)	(2)									(7)	(8)
Perak	238,420	10,857	4.6	28,887	12.1	39,744	16.7				
Selangor	294,030	13,618	4.6	36,261	12.3	49,879	16.9				
Negri Sembilan	217,002	14,815	6.8	24,190	11.1	39,005	17.9				
Pahang	35,122	3,438	9.8	4,461	12.7	7,899	22.5				
Total F.M.S.	784,574	42,728	5.4	93,799	12.0	136,527	17.4				
Malacca	110,288	4,405	4.0	20,261	18.4	24,666	22.4				
Province Wellesley	44,055	4,940	11.2	7,681	17.4	12,621	28.6				
Dindings	6,700	194	2.9	1,251	18.7	1,445	21.6				
Penang Island	1,585	1,058	66.8	84	5.3	1,142	72.1				
Singapore Island	28,033	10,016	35.7	5,897	21.0	15,913	56.7				
Total S.S.	190,661	20,613	10.8	35,174	18.4	55,787	29.2				
Johore	313,385	27,676	8.8	41,126	13.1	68,802	21.9				
Kedah (a)	102,220	5,209	5.1	9,161	9.0	14,370	14.1				
Kelantan	16,785	6,742	40.2	1,590	9.5	8,332	49.7				
Trengganu (b)	4,300	Nil	Nil	Nil	Nil	Nil	Nil				
Perlis	624	308	49.4	156	25.0	464	74.4				
Total U.M.S.	437,314	39,935	9.1	52,033	11.9	91,968	21.0				
TOTAL MALAYA	1,412,549	103,276	7.3	181,006	12.8	284,282	20.1				

Notes:—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

2. Areas rested due to rotational tapping system end April (not included above): Acres F.M.S. 44,255, S.S. 15,848, U.M.S. 46,309, or 7.7 per cent. of tappable area (col. 2).

Compiled from Statistics prepared by the Statistics Department, S.S. & F.M.S.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF MAY, 1932.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FEDERATED MALAY STATES :—							
Perak	238,420	13,104	5.5	31,065	13.0	44,169	18.5
... ..	294,030	23,594	8.0	33,277	11.3	56,871	19.3
Selangor	217,002	19,096	8.8	23,861	11.0	42,957	19.8
Negeri Sembilan	35,122	4,288	12.2	4,913	14.0	9,201	26.2
Pahang	...	...	...	...	...	...	...
Total F.M.S.	784,574	60,082	7.7	93,116	11.9	153,198	19.5
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	4,419	10.0	8,099	18.4	12,518	28.4
Dindings	6,700	389	5.8	1,126	16.8	1,515	22.6
Malacca	110,288	5,672	5.1	20,912	19.0	26,584	24.1
Penang Island	1,585	1,058	66.8	104	6.6	1,162	73.3
Singapore Island	28,033	12,992	46.4	4,506	16.1	17,498	62.4
Total S.S.	190,661	24,530	12.9	34,747	18.2	59,277	31.9
UNFEDERATED MALAY STATES :—							
Johore	313,385	38,125	12.2	41,686	13.3	79,811	25.5
Kedah (a)	102,220	5,209	5.1	9,161	9.0	14,370	14.1
Kelantan	16,785	7,726	46.0	1,590	9.5	9,316	55.5
Trengganu (b)	4,300	nil	nil	nil	nil	nil	nil
Perlis	624	308	49.4	156	25.0	464	74.4
Total U.M.S.	437,314	51,368	11.7	52,593	12.0	103,961	23.8
Total MALAYA	1,412,549	135,980	9.6	180,456	12.8	316,436	22.4

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.
(b) Registered Companies only.

2. Areas rested due to rotational tapping system end May (not included in above table) : Acres F.M.S. 44,862, S.S. 15,707, U.M.S. 50,536; Total 111,107 Acres, or 7.9 per cent. of tappable area (Col. 2).
Compiled from Statistics prepared by the Statistics Department, S.S. & F.M.S.

MALAYA RUBBER STATISTICS **TABLE I**
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVENUES,
FOR THE MONTH OF MAY, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1		Production by estates of less than 100 acres and over estimated 2		Imports		Exports including re-exports		Stocks at end of month	
	Dealers	Estates of 100 acres and over	during the month	during the year 1932	From Foreign	From Malay States	Local	Foreign	Local	Dealers
MALAY STATES:—										
Federated Malay States	18,695	12,812	11,800	58,939	8,111	38,188	NH	NH	17,010
Ipohore	2,573	3,430	3,512	18,184	3,259	16,934	NH	NH	13,501
Kedah	504	2,090	2,322	11,992	741	4,180	NH	NH	2,599
Kelantan	36	10	4	30	8	43	NH	NH	3,901
Kuantan	49	107	135	645	147	1,212	NH	NH	2,086
Perak	55	50	103	488	52	944	NH	NH	32
Tengganu	21,912	18,499	17,886	89,541	12,348	60,801	63	6	73
Total Malay States	170
SETTLEMENTS										
Malacca	4,433	1,332	1,292	6,676	(2)	(2)	NH	NH	55
Province Wellesley	86	562	506	2,059	1,731	9,274	NH	NH	50
Dindings	281	87	94	484	1,731	9,274	NH	NH	30,818
Penang	1,179	3,946	11	1	13	1	NH	NH	10,030
Singapore	3,056	35,823	239	136	772	...	NH	NH	3,311
Total Settlements	...	4,234	44,069	2,231	2,028	10,004	...	NH	NH	1,405
TOTAL MALAYA	...	4,234	65,981	20,790	19,915	99,545	14,079	70,075	4,559	13,663

TABLE II
DEALERS' STOCKS IN DRY TONS

Class of Rubber	Federated Malay States	Singapore	Province Wellesley	Ipohore	Total
20	21	22	23	24	25
DRY RUBBER	14,107	92,279	3,241	3,558	1,117
WET RUBBER	2,813	2,400	356	207	1,482
TOTAL	17,010	94,679	3,597	3,765	2,599

TABLE III
FOREIGN EXPORTS

Ports	For month	during the year 1932
Singapore	...	122,523
Penang	...	9,308
Port Swettenham	...	6,587
Malacca	...	482
MALAYA	...	40,297

TABLE IV
DOMESTIC EXPORTS

Area	For month	during the year 1932
Malay States	...	36,166
Straits Settlements	...	17,416
MALAYA	...	36,168

- Notes:—* 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. Consumption, i.e., Columns [13] + [14] + [17] + [18] + [19] + [20] + [21] + [22] + [23] + [24] + [25] + [26] + [27] + [28] + [29] + [30] + [31] + [32] + [33] + [34] + [35] + [36] + [37] + [38] + [39] + [40] + [41] + [42] + [43] + [44] + [45] + [46] + [47] + [48] + [49] + [50] + [51] + [52] + [53] + [54] + [55] + [56] + [57] + [58] + [59] + [60] + [61] + [62] + [63] + [64] + [65] + [66] + [67] + [68] + [69] + [70] + [71] + [72] + [73] + [74] + [75] + [76] + [77] + [78] + [79] + [80] + [81] + [82] + [83] + [84] + [85] + [86] + [87] + [88] + [89] + [90] + [91] + [92] + [93] + [94] + [95] + [96] + [97] + [98] + [99] + [100] + [101] + [102] + [103] + [104] + [105] + [106] + [107] + [108] + [109] + [110] + [111] + [112] + [113] + [114] + [115] + [116] + [117] + [118] + [119] + [120] + [121] + [122] + [123] + [124] + [125] + [126] + [127] + [128] + [129] + [130] + [131] + [132] + [133] + [134] + [135] + [136] + [137] + [138] + [139] + [140] + [141] + [142] + [143] + [144] + [145] + [146] + 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METEOROLOGICAL SUMMARY, MALAYA, MAY, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL							BRIGHT SUNSHINE				
	Means of					Absolute Extremes		At 1 foot		Total	Most in a day	Number of days				Total	Daily Mean	Per cent	
	Max.	A.	B.	Min.	Mean of A and B	Highest	Lowest	Max.	Min.			Precipitation, .01 in or more	Thunderstorm	Fog morning obs.	Gale force				
																			°F
		°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.	Precipitation, .01 in or more	Thunderstorm	Fog morning obs.	Gale force	hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor	91.1	73.3	82.2	94	70	86	76	85.2	85.3	5.39	136.9	1.21	17	14	5	2	179.75	5.80	47
Bukit Jeram, Selangor	89.4	73.7	81.5	92	72	85	76	85.3	86.8	2.15	54.6	1.37	9	6	1	5	196.95	6.35	52
Sitiawan, Perak	90.8	74.1	82.5	95	70	86	77	85.3	85.3	3.88	98.6	1.60	12	7	5		213.10	6.87	56
Kroh, Perak	88.1	70.9	79.5	91	67	82	74	84.2	83.6	5.06	128.5	0.87	21	17	1	1	208.70	6.73	55
Temerloh, Pahang	90.2	73.9	82.1	93	71	83	76	85.9	85.9	5.53	140.5	2.55	14	13	4	8	195.95	6.32	51
Kuala Lipis, Pahang	89.8	72.5	81.1	93	69	84	75	84.8	84.8	8.97	227.8	1.25	17	16	1	17	183.25	5.91	48
Kuala Pahang, Pahang	87.8	74.9	81.8	90	72	84	78	85.2	85.3	6.20	157.7	1.61	13	11		1	241.55	7.79	63
Mount Faber, Singapore	87.5	74.9	81.2	92	72	80	79	81.9	83.3	11.41	289.8	2.99	17	15	6	5	190.30	6.14	50
Butterworth, Province Wellesley	89.1	75.3	82.2	91	72	85	78	86.5	85.9	1.62	41.2	0.85	13	9		1	219.75	7.09	58
Bukit China, Malacca	85.9	74.2	80.1	90	70	79	77	84.1	84.9	4.54	115.3	1.69	12	7			207.15	6.68	55
Kluang, Johore	89.0	72.3	80.7	92	70	80	75	82.8	83.1	10.79	274.1	2.56	20	19	8	9	180.95	5.84	48
Bukit Lalang, Mersing, Johore	87.9	72.7	80.3	91	71	80	75	83.1	82.5	3.29	83.6	1.00	11	11	1	1	218.10	7.03	52
Alor Star, Kedah	90.1	74.8	82.5	95	72	85	77	87.9	86.9	11.44	290.6	3.66	14	13	11	1	247.85	7.99	64
Kota Bharu, Kelantan	91.7	73.5	82.6	95	71	89	75	85.5	85.2	1.57	39.9	0.64	6	5	1		261.75	8.44	69
Kuala Trengganu, Trengganu	90.7	73.3	82.0	95	70	84	75	85.5	85.7	2.01	51.1	1.39	7	5	2	1	255.80	8.25	67
HILL STATIONS.																			
Fraser's Hill, Pahang 4268 ft. Pahang.	75.0	64.5	69.7	79	62	70	66	71.8	72.2	8.32	211.3	1.60	22	18		11	126.95	4.10	33
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.7	58.5	66.1	77	53	71	64	70.5	69.8	11.13	282.7	1.25	30	24	3	9	130.85	4.22	34
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	72.6	60.8	66.7	76	59	68	62			13.12	333.3	1.57	29	27		4	136.35	4.40	36

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

AUGUST, 1932.

EDITORIAL.

Pig Breeding

The breeding of pigs in Malaya, particularly for the local market, offers many advantages to the stock-keeper. The country appears to suit them, for they are not only easy to rear, but they breed easily, producing full litters; they thrive, rapidly putting on weight; their food is generally inexpensive and most of it can be locally produced; and they are reasonably free from disease. Furthermore, there is a ready local market for pigs.

The foregoing should not be read to mean that the pig breeder can afford to neglect his stock. On the contrary, the difference between profit and loss will be found to depend on the knowledge and industry which is brought to bear on the new problems which must constantly confront the breeder.

The old idea that pigs are naturally dirty animals and that the condition of the styes, therefore, is a point of small moment has long been exploded. In a tropical climate it is doubly important that care be exercised to maintain hygienic conditions, for although as we have said, pigs are reasonably healthy in Malaya, they are by no means immune to disease and a malady contracted by one animal can rapidly become an epidemic.

The feeding of pigs presents no very great difficulties. The accumulated experience of the Chinese pig breeders of Malaya, in the matter of feeding, will well repay study, but that is not to say that improvements are not possible by the application of more modern knowledge of the balanced ration for pigs in various stages of their development.

Mr. T. D. Marsh, Assistant Agriculturist, contributes an article in this number on Pigs in Malaya. It is proposed in subsequent numbers of this Journal to publish further articles by the same author on Diseases of Pigs and on the Pig Farm at Serdang.

It is sometimes stated that there is little profit in pig raising. It must be admitted that when all the foodstuffs have to be purchased and transported, it is only under good management that profits can be made, but when one considers that the average Chinese squatter creates about 75 per cent. of the value of his pigs by his own labour devoted to the cultivation of suitable foods for his animals, it will be realised that he is of direct service to the country in reducing the amount of money spent in foreign countries for the purchase of foodstuffs for the population of Malaya.

International Dairy Congress.

In this number there appears an account of the ninth International Dairy Congress held at Copenhagen on July 14th to 17th, 1931, written by Mr. Curtler, Assistant Agriculturist in the Department of Agriculture who attended the congress as an official delegate from the Straits Settlements and the Federated Malay States.

The congress is of particular interest in that for the first time it included a section devoted to the consideration of dairying problems in the tropics.

It is a remarkable tribute to the advance which tropical agriculture has made that it can now be regarded as definitely proved that the production of high grade milk equal in quality to the produce of the most modern dairies in temperate climates presents no great difficulties and the day can be anticipated when the production and supply of milk under hygienic and controlled condition at least in tropical towns and cities will be regarded as much as a matter of routine as in centres of population in temperate regions.

One of the principal problems with which tropical dairymen is at present faced is the type of stock best suited to requirements, and on this the final word has by no means been said. Briefly the alternatives comprise —

- (a) the importation and acclimatisation of European breeds;
- (b) the improvement by selection of various races of cattle indigenous to the tropics; and
- (c) the evolution of new strains by crossing European breeds with native cattle.

Each of these systems has its advocates; it may be pointed out that under fully tropical conditions —

(a) is subject to the drawback that European milk cattle are liable to suffer considerably from the effects of the tropical conditions to which they are subjected on introduction and also exhibit a marked lack of resistance to the many ailments and diseases peculiar to the tropics to which cattle are subject. In relation to —

(b) native breeds of cattle are usually notoriously poor yielders and are difficult and intractable to handle. A modest degree of success appears to have been achieved in India in this matter but not, so far as is known, elsewhere up to the present.

(c) possess the advantage that crosses between European and native breeds combine to a considerable extent the docility and high-yielding qualities of the European breeds with the resistance to disease of the tropical strains. Such crosses are, however, liable to show variation in their descendants and the evolution of new fixed strains of mixed origin has not yet been achieved.

With further reference to (a) it should, however, be pointed out that in countries where conditions provide a climate that is not fully tropical or where a natural cold weather occurs, or even to some extent under fully tropical climates, the Friesian breed has become successfully acclimatised on a very, fairly extensive scale. For example in the sub-tropical regions of South Africa and Australia, in Hongkong, in Mauritius, in the higher parts of Netherlands India and in

some of the West Indian Islands the breed has become fairly established and in general stands out as the European breed of milch cattle which is best suited for acclimatisation to tropical conditions.

In so far as the establishment of fixed breeds from crosses between imported and indigenous races is concerned, the opinion may be advanced that this is work for the scientific breeder and that when the problem is attacked on scientific lines results are practically certain to follow in due course. This method, however, cannot be expected to yield fully satisfactory results so long as haphazard methods of breeding are employed.

The Malayan Exhibition.

The organisers of the Malayan Exhibition have the satisfaction of being able to look back on an event which has fully justified their expectations. In spite of the depressed condition of trade and of our main agricultural industries, exhibits in all sections were no less than in previous years, while in some sections they were more numerous. Moreover, it is understood that the Exhibition has proved to be a financial success.

We are, however, less concerned with the statistical result of the Exhibition than with its utility at the present juncture in assisting to ameliorate the conditions in which the inhabitants find themselves by reason principally of the collapse of the product upon which they had built their hopes.

The fact is now well recognised that the future prosperity of the country depends upon widening the basis of agriculture. The Exhibition may prove a pivot for further efforts in this direction, while the encouraging speech of H.E. The Governor directs renewed attention to the subject and indicates that Government bases its hope for the future prosperity of the country on making Malaya less dependent on the import of agricultural products which may be economically produced within its borders.

International Dairy Congress.

In this number there appears an account of the ninth International Dairy Congress held at Copenhagen on July 14th to 17th, 1931, written by Mr. Curtler, Assistant Agriculturist in the Department of Agriculture who attended the congress as an official delegate from the Straits Settlements and the Federated Malay States.

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Original Articles.

PIGS IN MALAYA

BY

T. D. MARSH,

Assistant Agriculturist.

The husbandry of pig raising in Malaya is chiefly in the hands of the Chinese, the flesh of the pig constituting almost exclusively the meat portion of their diet.

The Chinese population in Malaya numbered in the census in 1931, 1,710,024 (preliminary report) so it may be appreciated that a large amount of pork is consumed.

Although the industry of swine husbandry is a large one, the number of pigs recorded by the Department of Statistics Annual Report for 1930 in Malaya was 366,397 head, the imports from foreign countries are far greater than they should be considering the fact that swine can be economically fed on locally grown crops

The number and value of net imports into Malaya of live pigs and their products during 1931 were as follows:—

Swine 147,351 head valued at	...	\$ 2,735,845
Pork, fresh, frozen, and salted 289 tons		
valued at	...	\$ 213,087
Bacon and hams, 287 tons valued at	...	\$ 312,350
Total value of net imports	...	\$ 3,261,282

These figures could be greatly reduced by an expansion of the pig raising industry to the great advantage of the resident population.

This branch of animal industry, apart from poultry, is the only one that can be practised almost from the first pioneering stage of the opening up of virgin jungle, inasmuch as quick-growing and maturing crops may be cultivated for food and suitable primitive housing accommodation can be provided from materials obtainable in the jungle.

Diet in Relation to Meat

The local trade prefers pork that is the result of feeding pigs, at least until they are fattened for slaughter, on a soft diet composed of succulent vegetable foods. The Chinese contend that such pork after cooking is softer and more palatable than pork which is derived from pigs fed on concentrated foods for the greater part of their life.

It is necessary, however, as the animals approach the killing age to augment the soft vegetable diet with concentrated foods, so as to obtain the desired degree of fatness, and carcase weight.

The preference for such carcasses places pig raising in the hands of the vegetable gardener and small squatter, who can utilize such vegetables as are not sold for human consumption in addition to the economical growing of special crops for feeding to the animals.

As the Chinese have for generations been feeding swine in this manner, the people have become accustomed to eating soft pork and prefer it to the firmer flesh such as that marketed in the Western world.

The market in Malaya deals exclusively in pork, so that the whole of the carcase is consumed in the fresh state. There are no large bacon or ham curing factories in the country, although the Chinese cure a certain amount of pork and hams for their own market.

In the past, the Chinese have preferred a fat heavy carcase, but the modern demand in Malaya by people other than the labouring and poor classes, is for a smaller carcase in which the proportion of lean to fat is greater. This change of taste is following that of the Western world, and may be due to the greater wealth of the community and the higher standard of living, or it may be due to a change in the vegetable portion of the diet of the Chinese people. The eating of lean meat with rice makes a better balanced ration than the consumption of a large proportion of fat with the same grain. It may here be noted fat meat contains a higher amount of energy producing food than lean meat, as it contains practically no water, whereas lean meat contains a fair proportion of moisture; fat meat would suit the manual worker and be more economical to him, provided his vegetable diet was rich enough in proteins, and it would be so in many parts of China where soya beans are the staple vegetable diet.

Meat from the young, quickly grown animal contains more lean than fat, the joints are smaller and as such, they suit the poorer class of people. Such animals are far more economical to feed to a given weight than are animals slaughtered when almost mature, since young pigs will gain one pound in weight for every four to five pounds of concentrated foods consumed, but as they approach maturity the increase in weight in proportion to the food assimilated decreases until the gain scarcely pays for the food eaten.

All animals require what is known as a maintenance diet, which is necessary to maintain life without loss or gain in weight. It is only food consumed in excess of the maintenance diet that can be utilized for increasing the weight, or similarly to produce milk or young.

Development of the Pig.

The larger breeds of pigs continue from birth to gain in weight at a faster rate and for a longer period of time than those of the smaller breeds, since the mature weight of the small breeds being much less, their increase in weight becomes slower in proportion to the food eaten.

The "porker" carcase weight which is about 70 lbs. is within the fast rate of growth of the larger breeds, and contains a greater percentage of lean meat. The smaller breeds of pigs tend to lay on fat in attaining the weight required. They become less economical as the maintenance diet has to be given for the longer period.

The above facts have a bearing on the use of the larger European breeds for crossing with the local Chinese pigs which partly accounts for the ability of the offspring to attain a killable weight at an earlier age than the local pigs. It is a well-known fact in stock breeding that improved races of farm animals make a faster growth for a given amount of food consumed than the unimproved breeds.

Pigs are the only temperate climate farm animals that can be transferred to the tropics, and be just as suited to the conditions as they are in their native habitat, provided shade is available for them, and the requisite care is taken against internal parasites. The latter precaution is equally necessary for the local animals. This adaptability may be due to the origin of the western breeds, as history tells us that the Chinese breed has been extensively used in the establishment of most of them.

The pig is a very prolific animal, the sows having two litters in the course of a year, and both sexes are quite mature for mating at eight to nine months old. It can thus be readily appreciated that a small expenditure in stud animals can in a very few years rapidly change the whole stock of the country. The first stud pigs at the Experimental Stock Farm at Serdang were imported at the beginning of 1929. Their progeny are now widely distributed throughout the country.

The Chinese Pig.

The common pig in Malaya is the black, or grey and white Chinese breed. It is noted for its prolificacy, the number of pigs in the litters averaging 10 to 12 while the sows make careful and docile mothers. This breed is reputed to be able to lay on flesh when comparatively young without unduly increasing the proportion of offal and bone. They are, however, slow to mature.

In texture the skin is fine and sparsely covered with hair, the head is of medium length, not too large, with small erect ears, the shoulders are taller and heavy in comparison with the hind quarters, the back is curved and they have a fairly steep croup, the legs are short with weak pasterns, so that the fetlocks rest on the ground. The udder hangs very low, and when the sows are pregnant, or in milk, it rests and trails on the ground. The greatly distended abdomen seen in Chinese pigs is caused by the almost universal custom of feeding on bulky vegetable foods mixed with an excessive amount of water. If the same ration is fed and water, ad lib. is given separately, the pigs lose this abnormal dimension.

The flesh is considered to be of good quality. This is no doubt partly due to the custom of using a succulent vegetable diet as opposed to highly concentrated foods. The Chinese pig has been used with the Neapolitan breed in the establishment of the improved breeds of Europe and the Western Hemisphere, and the crossing of these pigs with the European breeds amounts to little more than the use of greatly improved strains of the same breed.

Breeding from immature animals, especially boars, is the common practice amongst Chinese in Malaya, which must encourage early maturity and reduce the mature size and weight. The question arises whether this practice is popular with the set purpose of early maturity, or whether it is fear on the part of the pig keepers of using a mature boar, and the difficulties encountered in view of the usual custom of carting or leading the stud boar from one holding to another. It is a fairly common sight to see boars being walked, or transported about the country in a basket on the carrier of an ordinary bicycle. The castration and marketing of immature stud boars may be practised to avoid the comparative low value of the flesh of old mature stud animals.

To revert to the hollow backs and flat pasterns, these malformations can be greatly minimised by feeding the animals with minerals from the time they are weaned, or by feeding crops that have been grown with the use of lime and phosphatic chemical fertilizers.

Another distinct type of local pig is an all black animal having many of the characteristics of the piebald type. They are shorter in the body and possess better hind-quarters. These pigs are also very prolific, the udder rests on the ground even more so than the previously described type, they make excellent mothers having a large supply of milk, and they cross very successfully with the Large Black and Middle White breeds. Other strains of pigs varying from the two types described may be due to crossing, or local selection or the crossing with local pigs of imported European stock. Some strains appear to have some of the characteristics of the Large Black and Poland China breeds.

Breeding and Selection.

When selecting the breed of pigs with which to commence pig farming, the merits of the different types should be considered for the particular market in view; for instance, if the principal trade is for porkers for the European population, then one of the large breeds such as the Large Black, Large White or Tam-worth would be suitable, since these breeds produce a porker carcase with a high percentage of lean to fat. Conversely, if a carcase is required for the Chinese market, carrying a greater proportion of fat than the Middle White, Berkshire or Poland China would be suitable.

The above recommendations would also apply to the use of boars of the improved breeds when used for crossing with the Chinese pig, as the offspring invariably follows the boar in characteristics. Again, if animals are required to forage on a free range for a part of their food, then pigs with a long snout such as the three large breeds above mentioned are better adopted to such conditions.

Animals bred from healthy vigorous parents should be selected. It is desirable that the mothers of breeding animals be docile, prolific, and have at least twelve well developed teats and preferably fourteen or more, they should be good milkers and retain a good flow of milk until the litter is weaned. Unless sows have such characteristics they cannot produce good uniform litters. A good mother will lose condition when feeding her young in spite of being fed with a liberal diet of good nourishing food.

Weaners chosen for breeding purposes should be symmetrical, and have their breed characteristics well defined. They should have a fairly straight back from the shoulders to the tail, with well sprung ribs, a wide chest and wide in the loin, the hind quarters should be wide, deep, and square, the head, neck and shoulders should not be too heavy as such a conformation gives a greater proportion of the cheaper coarse meat. It is generally recognised by the trade that meat from the hind quarters of all farm animals is better than that obtained from the fore quarters. The fore legs should be set fairly wide apart and be neither knock-kneed or "pigeon toed". Young sows selected for breeding should have fourteen or more teats without any "blind" dome-shaped ones. A lesser number of teats causes weakling pigs in large litters.

The age recommended for the first mating of both sexes is eight to nine months. Some people breed from them before attaining this age, and although the practice encourages early maturity in the offspring, it has a tendency to stunt the growth of the breeding animals.

Some breeders contend that a sow will grow equally as well when she is pregnant as when she is not, while others maintain that the practice prevents a proper development of the frame. The tendency amongst present-day pig breeders is to breed from young animals, as by so doing the animals become quickly profitable. Furthermore, there is a danger of young sows becoming sterile if mating is delayed too long.

Pigs chosen for stud purposes require plenty of exercise and should be maintained in a healthy, active, thriving condition. They need in addition to the concentrated ration a liberal supply of fresh succulent green foods, or have access to a grazing ground. A daily bath in fresh running water should be given. The sexes must be separated at an early age and preferably at weaning time.

Young boars that are not required for stud purposes should be castrated at about six weeks old. At this age the shock of the operation is not great, and the young pigs, while still suckling their mother, will scarcely suffer any inconvenience. The operation is a simple one. Absolute cleanliness is essential; an aseptic sharp knife, and one dressing of an antiseptic ointment at the time of operation is all that is necessary. It is advisable that the incisions made for the removal of the testes be low enough so that no pocket is formed, and any discharge can easily drain away. The newly castrated pigs should be housed on a clean concrete floor and be given clean bedding to eliminate as far as possible the entrance of dirt into the wounds.

Ruptured pigs should be castrated by an expert or left entire, and slaughtered at an early age. It is doubtful whether the spaying of sows that are not required for breeding is commensurate with the danger of complications and the advantages gained. There is no question about the fact that such sows feed better; unspayed ones become restless and go off their food during the periods of oestrums. It is advisable to slaughter them between a period; this is essential if the flesh is to be cured for bacon and hams. In pig raising districts in Malaya itinerant spaying experts are available who become very proficient in carrying out this operation and their charges are very moderate. The danger of such persons introducing such diseases as swine fever must not be overlooked.

The Sow.

The pregnant sow should be allowed plenty of exercise up to the time of farrowing. It must here be remarked that some Chinese sows become so heavy and low in the udder that they are almost incapable of taking exercise. The sow requires a light diet of vegetable food supplemented with concentrated foods to keep her in a healthy but active condition. She should receive a little more food as the time of parturition approaches. After farrowing, the food should be of a sloppy laxative character for a few days, after which the ration may be gradually increased so that her condition be maintained and she will be able to produce a good supply of milk. The change of food should be gradual. This applies to all classes of animals, as sudden changes of diet often cause digestive troubles, and in the case of the milking sow it sometimes alters the character of the milk and causes digestive derangements of the piglets in the litter.

It is advisable to move the sow to the farrowing pen a few days before she is expected to have her litter, so that she will become accustomed to her new quarters.

A fairly large pen is desirable with a limited amount of bedding such as dried "lalang" grass cut into short lengths. A guard rail about nine to twelve inches high and nine inches from the wall should be constructed all around the inside of the building, except where the feeding trough is situated to prevent the sow from lying on members of her litter. If any space is not guarded the sow will litter in that particular place, as she prefers to lie with her back against the wall; the young pigs invariably nestle under the rail against the wall.

It is advisable to paint the navels of the young pigs soon after farrowing and again the day following, with tincture of iodine. It has been found that this treatment prevents bacterial infection, and is a useful preventative against diarrhoea which often occurs in suckling pigs at the age of about three weeks.

A careful watch must be kept for blow flies in the sow immediately after farrowing, and also in the navels of the pigs in the litter. Powdered iodoform dusted onto the affected parts or used as an ointment is a useful preventative.

Weaning and Diet of Young Pigs.

Suckling pigs may be weaned at eight weeks old, and if two or three of the weakest pigs are left with the sow for a further few days, the shock of weaning

is not so severe to the sow and the practice considerably helps the backward pigs. The alternative method is to allow the litter to have access to the mother twice a day for a few days, then once a day, and finally kept away altogether.

Some sows come into oestrus 3 days to one week after the litter has been removed, and afterwards every three weeks. The period of gestation is 112 days, so that with two months suckling two litters can be produced per annum. Should the sow be emaciated at weaning time it would be advisable to allow her to have a rest before again mating her.

Young pigs commence to eat at the age of four to five weeks. They should be encouraged to take milky foods if available to which a little easily digested meal, cake, or boiled rice has been added. It is good practice to allow the sow and her litter to graze after the litter is from two to three weeks old.

The number of litters a sow will produce is a debatable question, but in general, breeding may be continued if a sow regularly produces healthy uniform litters of a fair average number. The usual small pig or two in an otherwise good litter should not be considered to be a fault. It is essential that she has a sufficient flow of milk to feed the litter, and the flow should be maintained until the litter is weaned. When the number in the litter falls or is very uneven, or if a sow commences to eat her young, then it is advisable to feed her for slaughter.

It is possible that the cause of sows eating their young is lack of essential minerals in their system. Sometimes when the members of the litter are fighting for possession of the teats, they bite them causing pain to the sow. On such occasions, vicious sows will bite the offending piglet, and if blood is drawn the sow will often proceed to eat the young one and afterwards she may eat the whole litter. This is one sound reason why a strain of pigs having a docile contented temperament is desirable.

A useful innovation in the tropics is a permanent concrete udder bath for sows in milk. This is best placed under cover, as near to the farrowing pens as possible, and in a position where all the sows will of necessity have to pass through it on their way to the sty after taking their daily bath or exercise.

The bath at the deepest part should be about six inches with sloping floors at the entrance and exit, and about four to six feet long. The object of such a bath is to contain a non-poisonous dip or disinfectant which will destroy all parasites or eggs of parasites that might be adhering to the udder of the sow. It is an excellent preventative against internal parasites and disease germs attacking the sow and the young pigs. Proprietary dips are on the market, or bleaching powder in the proportion of one pound to 20 gallons of water is suitable for this purpose.

These baths are specially useful for Chinese sows whose udders drag along the ground when they are suckling a litter.

It has been observed at Serdang that the litters of pure bred Middle White sows average about ten, of which about eight are reared. The Large Black breed is more prolific and they rear 8 to 10 pigs per litter. In respect of prolificacy normal animals of both breeds retain the characteristics they exhibit in temperate climates.

The Boar.

The custom of local breeders of using immature boars and moving them from one holding to another has been mentioned, and the fear of handling mature boars no doubt has played a great part in the establishment of this custom. It must be appreciated in this respect that the Chinese pigs are not so docile generally as pigs of the European breeds.

Selection for Stud Purposes.

Insufficient care is usually taken in selecting the boar. The Chinese apparently believe in the old adage that most of the breed is transmitted through the feeding trough. The modern thought on the subject of heredity that the male is far more than half of the herd, should be acknowledged. The male invariably transmits more of his characters to the offspring than does the female and for this reason it is essential that boars for stud purposes should be carefully chosen.

In selecting a boar it is advisable to know the mother and her degree of productiveness, whether she produces even litters of good pigs, as opposed to the sow having one or two outstanding pigs in an otherwise poor litter. The strain of pigs should be docile, true to type and vigorously healthy. The young boar should be selected when he is a weaner, so that one of the most vigorous pigs in the litter can be chosen. Many breeders would discard an otherwise good weaner boar if he did not possess twelve to fourteen rudimentary teats.

Care of the Stud Boar.

Young boars should be segregated from the herd. They require plenty of exercise, preferably on a grass run, they must have a dry bed, and a daily bath. A diet of nutritious vegetable foods supplemented by concentrated meals, is required to keep them in a thriving condition and they should not be allowed to become too fat.

The boar may be used for breeding between the age of eight to nine months to 5 or 6 years old but he should not be used too frequently.

The Chinese custom is to use one boar to about 120 sows and the service fee is \$1 per sow. The boar is allowed to serve about 20 sows per month, which is heavy duty; on these figures the boar keeper obtains an income of about \$20 per month.

The boar's ration is about 3 kati (4 lbs.) of boiled rice per day with sweet potatoes or other vegetable food, supplemented with 2 or 3 duck or fowl eggs daily.

The use of the usual type of poor, immature, undersized native boars is to be deprecated. Such stud stock must have a tendency to lower the quality of the pigs in successive generations.

Pure bred boars of good type European breeds are strongly recommended.

Cross Breeding.

It has been observed in cross breeding experiments at Serdang that when Chinese sows are crossed with boars of the Large Black and Middle White breeds a remarkable improvement in comparison with the sows has been obtained even in the first generation. In size, conformation, and vigour, the litters have almost invariably the characteristics of the boar, even to colour in the case of each breed; the hollow backs and flat pasterns are absent. It must, however, be acknowledged that the young animals are well fed and receive minerals in their rations.

Similar success has been achieved in the use of the Poland China breed crossed with native sows, at the Central Mental Hospital, Tanjong Rambutan, but at this Institution the same breed of boar was subsequently used on half and quarter bred sows with no outstanding reversion, even in isolated individuals. to the type of the local pig. The offspring in succeeding generations more strongly resembled the Poland China breed

The same results have occurred at the farm of the Singapore Cold Storage Co. at Singapore when using boars of the Large White breed. The policy adopted by this company is to use this breed for cross-breeding and intermittently every few generations use a good type, cross bred boar to infuse once more the characteristics of the local breed into the herd.

It is not considered that the use of a boar of the Chinese breed crossed with European sows would produce the same improvement in type of the offspring, owing to the prepotency of the male in the breeding of farm animals.

The native pigs are eminently suited to the country and the Chinese methods of feeding. The practice of continually mating pure boars of a European breed with the cross bred progeny would in a few generations produce a type of pig practically identical with the breed of the boar, with the gradual extinction of those good characteristics of the Chinese breed which it is desirable to retain in the pigs in Malaya, and it would no doubt be advisable to use as a sire every third or fourth generation as previously mentioned, a good half bred boar to infuse again into the herd the characteristics of the Chinese pig.

It would no doubt be a better policy to improve by selection a good pure strain of the Chinese breed for the purpose of providing breeding stock for crossing with the European blood, but until such time as improved native stock is available, a cross bred boar having increased vigour, size, and a better conformation would be preferable to the animals that may be seen at stud in Malaya.

One of the best methods of importing pigs into Malaya is in the form of pregnant sows. The sow should have been pregnant for at least one month before shipping. In this way the sow and litter is landed at little, if any more cost than one mature pig of either sex, and the offspring have a better chance of becoming acclimatised by the time they mature and are less likely than older imported animals to suffer from the affects of the heat. The pigs of the litter that are not required should be saleable for stud purposes at prices nearly sufficient to cover the cost of the importation.

The difficulty of mating large boars with small sows which is bound to occur on the farm of the progressive breeder sooner or later, can be overcome by the use of a service crate, the principal function of which is to support the boar during the act of service.

Probably the best type of crate is about two feet wide and 4 to 5 feet long, open at one end with strong battens bolted along the sides at fairly close intervals with a space of about two inches between them, on which at a height just above the sows back can be placed loose cross boards to carry the boars' weight. These cross boards can be placed higher or lower according to the height of the sow.

Some Chinese Methods and Customs.

Chinese pig keepers market their animals at 8 to 10 months old at an average weight of 130 kati (about 173 lbs.) but the weights vary at this age from 75 to 175 kati (100 to 233 lbs.)

The maximum number of sows that a market gardener or small cultivator will keep is about seven. The work of attending to them is in addition to his routine work in the garden. He grows all his vegetable food for the pigs and purchases only rice, rice bran, and fish meal. A few pig keepers feed imported sago refuse.

The foods given to sows per day is composed of about 1 lb. rice bran supplemented with 20 lbs. of a mixture of tapioca roots and leaves, sweet potato haulms, and about $\frac{1}{4}$ lb. per head of fish meal. Sometimes the inside leaf sheaths of banana plants are used. The ration is boiled and given twice daily.

Suckling pigs are fed three times daily on boiled rice only. On approaching the age of about two months, boiled sweet potatoes and rice bran are added. Tapioca is fed only after the pigs are over 4 months old. At 5 to 6 months old the ration is similar to that fed to sows.

Water is thrown over the pigs always after feeding, that is, three times daily in the case of young pigs, and twice daily in the case of mature pigs. They do not, as a rule, have any other regular bath.

The simple operation of castration is usually performed by the breeders, but the spaying of sows, which is a common practice, is a more serious operation and an expert is employed for this work. His charges are about 20 cents per head. The operator is invariably proficient and there are seldom any serious effects on the spayed sows after the operation.

Housing.

The Chinese squatter usually builds a low, badly lighted shed, constructed of round jungle timber with "lalang" grass (*Imperata arundinaceae*) as a thatch; split slabs of timber are laid down for the floor, later he will put down a concrete floor connected by a drain to a small reservoir in which he collects the urine. His principal object in laying the concrete floor is probably to catch the drainage for use on his vegetable garden, the comfort of the pigs being a secondary consideration.

Pigs are most susceptible to damp sleeping quarters and to maintain them in health it is essential that they be provided with a dry bed.

The animals should not be overcrowded. Sufficient space is necessary for free movement, otherwise they will foul their own bed. Ordinarily, they are not dirty animals and provided the styres are regularly cleaned, they will develop clean habits.

Temporary sheds are not recommended as they are difficult to keep hygienic; such houses are, however, often necessary owing to lack of capital.

Roomy, rain proof, well-ventilated and lighted sheds, preferably of iron and concrete, are advocated as soon as circumstances permit; cracks and crevices in the walls and floors harbour dirt and parasites.

Suitable pens for store pigs are about 10 feet by 7 feet. Farrowing pens should be larger and 10 feet by 15 feet or slightly smaller are convenient dimensions. Some breeders prefer to have a shed containing a single row of pens; they maintain that ventilation is better and supervision is more thorough, since an attendant will normally only traverse each shed once during his round of inspection. Houses with a central passage and a double range of pens are cheaper to construct for a given number of livestock, and are in many respects ideal.

The floors should be of concrete with a portion of each pen raised about 2—3 inches on which the pigs can make their bed. Bedding or dried grass or such similar material is necessary as it is inadvisable for pigs to lie on cold damp concrete.

A layer of asphalt laid in the concrete about 2—3 inches below the surface is sometimes recommended to prevent the moisture from below coming through the floor. Floors should have a gentle slope to one side of the building, a fall of one inch to ten feet being suitable, so that all liquid manure will flow away to the drains.

If the feed troughs are arranged along the passage running through the centre of the shed and the sleeping quarters are along the outsides of the building, then the slope can be made towards the feed passage and a narrow open drain along each side of the feed passage should be constructed. It is preferable, if it can be arranged, to put the trough adjacent to the floor on the high level, as the pigs will usually defecate at the lowest floor level.

The drains should be of the open type. Underground drains are liable to get choked, the outlet drain should have, at a small distance from the building, a bye-pass leading into a urine tank so that when washing down the pens, the water may be allowed to flow away. Alternatively, a stop can be put into the drain to cause the liquid manure to flow into the tank. It is advisable to empty this tank daily. Outside rain water drains should be separate from the inside drainage system.

All floors should be roughened by brushing the top rendering of concrete with a stiff broom just before the cement has hardened. In this manner, a close grained finish can be made which is neither slippery nor porous; in addition,

it is recommended that the surface be marked by crossed grooves about half an inch deep and spaced about 6 inches apart to form parallelograms. Such grooves should be constructed along the slope of the floor so that they conduct the water to the main drains.

The roof may be constructed of asbestos cement sheets or corrugated iron; attaps or thatch are no doubt cheaper and cooler, but for hygienic reasons one of the former is preferred. The sides of the building and the end least exposed to the weather may be open, or closed with expanded metal only. A liberal overhang of the roofing sheets is recommended.

Feeding troughs may be made of concrete, finished with a fine polished rendering; half section glazed tiles, white, or brown, embedded in a concrete base, are however better. Troughs should be fastened down so that the animals cannot move them about. The best type are constructed of cast iron set in the walls of the feeding passage with a swing door above them, hinged at the top horizontal edge so that it will shut and fasten to both sides of the trough. With such an arrangement, the pigs can be shut away whilst the food is being poured into the trough or it is being cleaned. This type is installed in the piggery at the Government Experimental Plantation, Serdang. The above-described type could be constructed locally of hard wood.

Shade, which is necessary in the open runs, can be provided by the planting on the outside of the fences, but adjacent to them, the West Indian Cherry tree (*Muntingia calabura*), or other suitable trees; trees planted inside the pens must be protected even after they are full grown to prevent the pigs from eating the bark and so killing the trees. All pig styes should be periodically lime washed; the addition of about 1 lb. of bleaching powder to a bucket of lime wash will aid in the destruction of parasites.

Feeding.

Pigs, having a comparatively small stomach, require easily digested foods; large amounts of fibrous bulky foods are unsuitable. They nevertheless require a certain amount of succulent food in the form of vegetables or grasses.

Guinea grasses (*Panicum maximum*) or other fodder grasses, if cut at intervals of about two to three weeks, make excellent fodder. Grasses are greatly relished by animals of all ages.

The vegetable foods used by the Chinese are sweet potato haulms and tubers, tapioca leaves and tubers, Keladi (*Colocasia sp.*) tubers and leaves, the white inside leaf sheaths of bananas, and swamp land 'kankong' *Ipomea reptans*. Yams (*Dioscorea sp.*) are being used more than formerly.

These foods are boiled as it is considered that cooked vegetables are safer to feed and are less liable to cause digestive troubles. Boiling is a well-established custom although it is a well known fact that cooking destroys certain food constituents, impairs digestion to some extent and is expensive. It is not recommended without more evidence, that such foods be given in the raw state.

Some breeders purchase tapioca refuse and imported sago refuse and use it to replace part of the usual vegetable diet.

Concentrated Foods

The concentrated foods principally used by the native breeders are rice bran, and broken rice; the latter is also cooked and forms the basic diet for weaners. A small amount of fish meal is given in the rations of pigs after they are a few months old. Tapioca is not included in the ration until the animals are about four months old.

There is no reason why other concentrates obtainable in Malaya should not be fed to swine, and a study of their values compared with market prices would enable the progressive breeder to obtain the greatest amount of nutrients for the expenditure on food.

A mixed diet is always preferable to one composed of one particular meal. The body can obtain its requirements more easily from a mixture; some meals are deficient in minerals, others have an influence on the carcase, for instance, a diet of maize will produce a soft yellow fat; beans, peas and probably the Indian grams produce a hard stringy pork if fed in excess.

The nutritive ratio is easier to balance with a ration composed of mixed meals, and it has been found in practice that the feeding of mixtures is more economical. Animals will gain weight faster if fed on a mixed ration, even if the calculated value of the mixture is apparently identical to that of a ration composed of a one kind of grain.

The following concentrated foods are recommended for pigs in Malaya; maize, soya beans and cake, rice bran, broken rice, gingelly cake, coconut cake, sago and tapioca refuse, Indian grams and other pulse.

It is not proposed to lay down any hard and fast rules regarding rations, as the economical feeding of pigs depends on the supply of cheap starchy foods augmented with the cheapest suitable concentrated albuminoid food procurable.

The nutritive ration mentioned earlier, is the amount of digestible protein compared with the total of the digestible fats, starches and sugars.

Young pigs require for their successful growth a ration of 1 of protein to about 4 of non-proteins which may be widened as the pigs become older. When they are being fattened a ratio of 1:6 or 6.5 is the most economical to feed. Breeding sows fare best on a ratio of about 1 to 5.

The practical application of the foregoing in the case of young pigs over 4 months old is to feed those constituents rich in carbohydrates such as tapioca and sweet potatoes, cooked and mixed at the rate of about three pounds per day with one to two pounds of meals or cakes composed of soya bean, coconut cake, rice bran, and gram or gingelly cake, if the last two are not too expensive, with an allowance of fresh grass cut daily or grazed ad lib.

In the absence of milk, cooked broken rice and a little rice bran with fresh cut or grazed grass is probably the best ration for weaners. It might be mentioned here that rice is used in some countries as a corrective for diarrhoea in young pigs.

Breeding sows and boars may be given per day about 10 lbs. of vegetables and 1—2 lbs. of concentrated foods with grass or grazing ad lib.

Fattening pigs can be fed on a ration consisting 3—4 lbs. of a mixture of concentrated foods, with grass, and 10 lbs. to 12 lbs. of vegetables.

Grass cut at intervals of about three weeks has a well balanced ratio of proteins and non-proteins, and if fed in lieu of sweet potatoes, sago or tapioca, would cause small requirements of highly concentrated protein foods. Broken rice, rice bran, and maize, if reasonably cheap, could be substituted for the above-mentioned cakes and meals.

As sweet potato and tapioca tubers can now be purchased, delivered at about \$1 Straits (2s. 4d.) per picul (133½ lbs.) the ration should, in the absence of home-grown foods, for economical reasons be made up to include these foods.

Foods should be given in a fairly dry state, but wet enough to eliminate waste. Fresh water should always be available for the animals. Weaners should be fed three times daily; pigs from 3 to 4 months old may be fed twice per day, but the hours of feeding should be regular.

It is generally considered that soaking concentrated foods for a few hours before feeding is better than boiling. Care must be taken that such food does not become sour. Only sufficient food should be given that the animals will eat in one meal. If it is left to go sour in the feeding trough, it becomes stale and unpalatable and causes the animals to go off their feed. Changes in the diet should be effected gradually otherwise there is a danger of causing digestive troubles.

The feeding troughs of tropical pigs in small pens should be cleaned after meals and filled with clean water, and it is desirable that animals in open yards or grazing areas have access to running water.

Grass may be cut at intervals of about two to three weeks. At this stage the fibre content is low and the protein is high. Some tropical grasses if they are cut and fed at shorter intervals contain certain poisonous properties and may cause some derangement of the digestive system with diarrhoea.

Uncooked tapioca roots should be fed soon after they are harvested as chemical changes take place in the outside coat and poisons are produced. Such poisons can be discarded by peeling the tubers; this, however, is not practicable.

The best method is probably to boil the roots immediately after lifting and not allow them to become stale before feeding. Excessive quantities of sweet potato vines also sometimes cause digestive troubles owing to the development in them of prussic acid in minute quantities.

The feeding of small quantities of very soft charcoal has a beneficial effect on the digestive systems of pigs kept in small pens.

Minerals.

It has become the practice during recent years to feed a proportion of minerals with the ration, the usual amount given is at the rate of 2 per cent. of the concentrates fed.

It is considered that the hollow backs and flat pasterns of native pigs may probably be attributed to the lack of mineral salts in the system. The eating

of earth by pen-fed animals when given range, can be attributed to their craving for mineral salts, probably phosphates and calcium.

The feeding of fish meal will overcome mineral deficiency to a large extent, but the best method of supplying sufficient minerals is by the application of chemical fertilizers on vegetable and grassed areas that are destined to provide the bulky food for the pigs. Such minerals that have been taken up by plants are in a more easily assimilable form than is the raw chemical fed in the daily ration.

A certain amount of mineral matter is necessary for the proper metabolism of the body, and comparatively large quantities are required by sows for the production of young and milk. If the ration contains insufficient quantities for the production of milk for the young, the sow will maintain the correct quantity in the milk she secretes, by drawing from the mineral resources of her own body leaving her own system deficient in inorganic matter. This probably is one reason why some breeders advocate the production of three litters in two years, as incorrect feeding makes it imperative that the sows be allowed a resting period to enable them to lay in a further store of mineral salts. It is known that animals can store minerals in their bodies and give up large quantities to their young when necessary, but such methods of feeding which call for suckling mothers to draw on their resources are not conducive to the best results, and it has been found in experiments that the feeding of sufficient mineral matter to all classes of animals increases the rate of growth and flow of milk considerably, and aids digestion, enabling them to obtain more nutriment from the food consumed.

Many proprietary mineral mixtures are on the market.

A home-made mixture can be made which is usually much cheaper than the proprietary article; a suitable one is as follows:—

Common salt	...	...	35	parts
Steamed bone flour	...	...	30	"
Wood ashes	...	...	15	"
Lime air slaked	...	...	10	"
Iron sulphate	...	...	1	"
Flours of sulphur	...	...	5	"
Magnesium sulphate	...	...	3.7	"
Potassium iodide	...	...	.3	"
<hr/>				
100.00				"

It is essential that the steamed bone flour be thoroughly sterilized, otherwise there is a danger of introducing anthrax.

REPORT OF THE NINTH INTERNATIONAL DAIRY CONGRESS 1931.

BY

E. A. CURTLER,

Assistant Agriculturist.

The writer of this report was selected as one of the delegates to represent the Governments of the Straits Settlements and Federated Malay States at the Ninth International Dairy Congress.

The Congress was held in Copenhagen from the 14th. to 17th. of July, 1931, all sectional meetings of the delegates taking place in the Christiansborg Castle, which is the Danish Houses of Parliament. The offices of the Congress were also in the same building. The delegates were accommodated in the hostels and pensions in the city.

Previous congresses had been held in various European capitals biennially commencing in 1903, with a break from 1914 to 1926, but during this interim a congress was held in the United States of America under the auspices of the "World's Dairy Congress Association", taking place in 1923. The next Congress will probably be held in Germany during 1933.

At the Copenhagen congress, forty-two countries were represented and of these thirty-two governments had sent official delegations. The largest delegation was from the United States of America and comprised ten members, then Germany and Belgium with nine each, while thirteen countries only sent one delegate. The total number of delegates attending the congress was just under seventeen hundred, of whom about two hundred were ladies accompanying active delegates.

The delegates represented a large variety of occupations including members of the research and teaching institutions of agriculture, veterinary and health officers, farmers, wholesale and retail milk dealers, representatives of firms making milk foods and chocolate, agricultural engineers, importers and exporters of dairy produce, also the press connected with the dairy industry.

The congress was divided into five sections which dealt with—

- (i) Dairy cattle breeding and milk production.
- (ii) Chemistry, bacteriology and hygiene.
- (iii) Technique, industry and trade.
- (iv) Organization, legislation and control.
- (v) Tropical dairy industry.

The sections met concurrently in different rooms with the exceptions of section (iv) which only met on the first three days of the Congress and section five which occupied section four's room on the last day of the Congress.

Inaugural Meeting.

The inauguration of the Congress took place in the Town Hall, Copenhagen at 4 p.m. on Monday 13th July, 1931. The delegates were welcomed by Mr. S. Overgaard, President of the Congress and Chairman of the Danish Section of the International Dairy Federation. During the course of his remarks he pointed out that Denmark took a particular interest in the dairy industry as that small country produces one-third of the butter exported in the world.

The President was followed by the Hon'ble President, Mr. K. Bording, the Danish Minister of Agriculture, who welcomed the delegates on behalf of the Danish Government. He stressed the value of the personal efforts of the Danish farmers, the government educational and advisory services, the co-operation between government and the agriculturists also the government control of the quality of the produce, in the maintenance of Danish agriculture. He pointed out that Denmark has the greatest agricultural turnover per head of any country in the world. In conclusion, he mentioned the value of international co-operation. Having thanked His Majesty the King of Denmark for his presence, he wished him a long and happy reign.

The congress was then officially declared open by His Majesty the King of Denmark.

Danish Agriculture.

Mr. Madsen-Mygdal, late Danish Minister of Agriculture, then delivered the inaugural lecture on the development of Danish Agriculture. He pointed out that in Denmark, farming and dairy farming are synonymous, as every farmer is a dairy farmer. He stated that the principal products are butter and bacon, which are not surpassed in quality by any country in the world. These products play a great part in the foreign trade of Denmark, as they, with the minor agricultural products, represent 77 per cent. of her export trade. The export of animal products is actually greater than from any other country in the world. He next mentioned that there are 42 cows and 148 pigs per 100 inhabitants. To feed this great number of live stock, 15 per cent. of the land is cultivated for roots and there is a large import of oil cakes.

This intensive animal husbandry has only developed during the last half century, since cheap American corn came on the European market.

He mentioned that the majority of Danish farmers are freeholders, hence the large amount of capital invested on the land and the intense interest taken by the farmers. This is helped by the Co-operative Societies, which provide most of the initial capital, so that the farmer has his own money available to make improvements.

The holdings in Denmark are mostly small, so the owner is able to give personal attention to detail.

During the last thirty years 18,000 small holdings have been established with government assistance, while 120,000 have been established by purely private enterprise.

Owing to the system of co-operative dairies, these small-holders produce a uniform product. The success of these small holdings has been aided by the training of the young farmers in agricultural schools.

The concluding speaker was the Italian Minister of Agriculture, H. E. Baron Giacomo who spoke of the value of dairy farming to a country.

Tropical Dairy Industry Section.

Section V, Tropical Dairy Industry did not meet till Friday the 17th July, which was a great disadvantage as one did not have an opportunity of making the acquaintance of the other delegates from the tropics till that day, except by chance.

Mr. J. F. Blackshaw, Dairy Commissioner of the Ministry of Agriculture, London, was elected chairman of the section.

The six papers read before the section were :—

- (1) "The genetical improvement of cattle in the tropics" by A. D. Buchanan Smith, University of Edinburgh, Animal Breeding Research Department.
- (2) "Dairying in the Dutch East Indies" by J. L. van Ech, Director of the Civil Veterinary Service.
- (3) "The possibilities from an extended dairy industry in the tropics, especially respecting experiences obtained in Kenya Colony" by Th. Fjord Jensen, Manager, Kenya Co-operative Creamery Ltd., Naivasha.
- (4) "Problems of tropical dairying" by John Hammond, School of Agriculture, Cambridge.
- (5) "Milk production in India" by Zal R. Kothavala, Assistant Imperial Dairy Expert, India.
- (6) "On dairy farming in Formosa" by Masayoshi Sato, Professor, Hokkaido Imperial University, Sapporo, Japan.

It will be noted that four of these papers describe the conditions obtaining in various parts of the tropics, while the other two are written by workers at research stations in Great Britain, but Hammond's paper was written after a short visit to the West Indies.

Dairying in Netherlands India.

Mr. J. L. Van Eck's paper was a description of the position in the Dutch East Indies at the moment and was illustrated by a number of lantern slides. The conditions are similar to those in the Malay Peninsula, in that the major portion of the dairy products consumed in the country are imported. There is one great difference, a small amount of butter being made in dairies situated in the higher elevations.

There is a large import of preserved milk, but it is possible that this will decrease in the future owing to the increase in the number of dairies in Java.

Dairy Farming in Kenya.

Mr. Th. Fjord Jensen first stressed that it was refrigerators that made world-wide trade in dairy products possible. He remarked that by the use of refri-

generators the tropics might participate in the production of goods for this trade.

His experience was obtained in the Highlands of Kenya, which are about 9,000 feet above sea level.

The cow kept by the native is the Zebu, which produces a small quantity of milk of good quality. Attempts have been made to improve the yield by crossing the Zebu with European cattle, usually the Friesian.

The bulk of the food for the cattle is the natural grasses, which are supplemented by a ration of concentrated foods and lucerne.

Disease is a serious obstacle to the development of cattle rearing in Kenya.

The cream, which is separated from the milk in centrifuges, is sent to the dairies, as far as 25 miles by road and then from 50 to 125 miles by rail.

Six years ago the government put a prohibitive tariff on butter, which has caused the production of milk in the country to be rather more than doubled. The tariff also resulted in the opening of three dairies which have recently merged into one company owned by the farmers.

A small export trade to London has now been established, and is increasing.

The dairy industry at present is all in the hands of Europeans who own about two and a half million acres of land suitable for the extension of dairy farming.

Formosan Dairy Farming.

Prof. Marasyoshi Sato briefly described the position and topography of the sub-tropical island of Formosa.

Dairying was first introduced with the commencement of the Formosa Government and advanced owing to the demand from the Japanese settlers.

Native cattle were first used, then Shorthorn and Ayrshire stock was introduced. Holsteins were imported at a later date and signs of their blood are visible in most of the cattle now seen in the island.

Owing to the European breeds being frequently attacked by piroplasmiasis, some stock of an Indian breed were introduced. These were resistant to piroplasmiasis but only gave a small quantity of milk which was, however, of good quality.

The present policy appears to be to select the best Indian cows and cross them with Holstein bulls.

Dairying in India.

Zal R. Kothavala first pointed out that the dairy problem in India is unique, in that the agriculturists are all poor men with small holdings, who have to use the same cattle for draft and milk production. The problem is further complicated by religious beliefs of a large section of the population, who object to any cattle being slaughtered or any male castrated. This results in many old and useless cattle being kept alive, also in the presence of undesirable sires.

The principal breeds of Indian cattle and buffaloes were then given.

The main problem in India to-day is to select from the existing breeds a "dual purpose" animal, that is, one which will produce a strong fast walking

male for draft purposes and a female that will give a satisfactory yield of milk.

To-day there is no dairy industry in India in the sense that is meant in Europe.

In the villages, where 95 per cent. of the population reside, each cultivator has on the average one cow and one buffalo. The former produces his working animals and the latter his milk. The milk is usually consumed by the cultivator and his household, either raw or made into butter or "ghee".

In a few cases dairies have been established, which manufacture butter from the cream and casein from the skim milk.

In the town the milk supply is produced by animals kept and fed in the urban area. The supply is usually produced under insanitary conditions and is not sufficient to meet the demand.

Indian Dairy Problems.

What is required is a system whereby the milk can be produced in the rural areas and transported to the towns. The problems affecting milk production in India were next discussed, these are :—

(i) Dairy education. The lack of trained men was severely felt in the past. Since the war an Imperial Institute of Animal Husbandry has been opened in Bangalore. This is supplemented by other institutions run by most of the provincial governments.

(ii) Breeding. The native cow is not profitable. It is late maturing, an irregular breeder and a poor yielder. The crossing of indigenous cattle with European dairy breeds was tried. The first cross gave excellent results, but subsequent generations could not stand the rigorous conditions in the villages. Pure line selection has therefore been substituted, with the result that selected heifers now produce their first calf at three instead of five years of age, the regularity of calving has been greatly improved and an average annual yield of 5,000 lbs. of milk per cow in a herd has been established, whereas the normal yield is only 1,000 lbs.

(iii) Feeding. Cows are usually grazed on common pastures or in forests where they do not obtain sufficient food, except during the monsoon. Storage of grasses and fodder crops in pit silos has been found successful.

Stall feeding has been found to be the most profitable system.

(iv) Disease control. An efficient control of "rinderpest" is reported. Research work is being carried on at the Imperial Veterinary Research Institute.

(v) Rearing. In-calf cows were usually left to get what food they could in the grazing areas. The calf was reared on the milk left by the milkers, an uncertain quantity. Cultivators are now being educated in the value of the proper feeding of the in-calf cow and of feeding the calf from a pail almost from birth.

(vi) Housing. In the sense used in Europe is not practised.

(vii) Production and handling of milk. This is the most difficult problem, in view of the temperature, dust and careless methods of the workmen. Pasteurising is being practised in the government institutions.

(viii) Transport of milk. Owing to lack of demand, no insulated trucks are available on the railways. Pasteurised milk in cans, insulated with wet straw and sacking, has been sent over 500 miles in parcel vans and after being pasteurised a second time at the end of the journey, it has kept for eight hours.

(ix) Retail distribution of milk. Capped and sealed bottles are being rapidly adopted in the big cities.

In reply to several questions at the conclusion of his paper Mr. Kothavala was emphatic that the better method of improving the cattle in India was by pure line selection, not by the importation of stock from other countries.

Genetical Improvement of Cattle in the Tropics.

In the unfortunate absence of A. D. Buchanan Smith his paper was read by one of his assistants. The paper consists of a discussion of the principles involved in the improvement of stock in the tropics.

The two usual methods of improving stock in the tropics are by the importation of cattle having the desired qualities or by selecting out the desirable specimens from the indigenous cattle.

The necessity for considering disease resistance and nutrition were next pointed out.

The primary functions of cattle were enumerated—

- (i) Milk.
- (ii) Meat.
- (iii) Draft.

The secondary functions as—

- (i) Hides.
- (ii) Bones.
- (iii) Creation of dung.
- (iv) As a sign of wealth, especially for dowry.
- (v) Religious purposes.

The points to be considered before dealing with the problem of improvement are—

- (i) Number and type of existing cattle.
- (ii) The existing market for such stocks.
- (iii) The potential market.
- (iv) The existing methods of husbandry.
- (v) Whether the existing methods are to be slowly improved or a radical change made.
- (vi) Is disease efficiently controlled and can it be in the future?

The four methods of improving stock are—

- (i) Elimination and replacement by imported breeds.
- (ii) To grade up native stock to the improved standard required.
- (iii) To infuse certain desirable characters into the native cattle, without losing their chief characteristics.
- (iv) By selective breeding of the native stock.

(i) This requires one of two conditions, either the environment or the husbandry should be similar to the country to which the cattle are to be imported.

(ii) Similar to (i) and only likely to be successful in countries with different climatic conditions, if, both nutrition and methods of husbandry can be made similar to those operating in the country from which the stock, used in the grading up process, is imported.

(iii) Only useful when the existing stock does not provide the local market requirements, or to introduce disease resistance.

(iv) This system allows the improvements in the methods of husbandry to be made, at the same time as the class of the stock is being improved.

"As a general rule, experience is showing that the development of the potentialities of the native races is the best method to follow in the majority of tropical countries."

From the sentence above it will be seen that Mr. Buchanan Smith is in full agreement with the policy of the Indian Dairy Expert on the question of the best method of improving the cattle in a tropical country.

Problems of Tropical Dairying.

John Hammond's paper is a survey of the problems of tropical dairying, based on a short visit to the West Indies.*

In a discussion on the question of feeding, he points out that in England the highest yield of milk is obtained in the spring when all the grass is young. A similar condition operates in the West Indies, where the highest yields are obtained in the wet season, again when all the grass is young. He suggests that the milk yield might be maintained during the dry season, by feeding ensilage made during the wet season.

During a short discussion on management he mentioned that grazing in paddocks shaded by Rain Tree (*Pithecolobium Saman*) gave excellent results, the paddocks being well watered and grazed in rotation.

He mentions three methods of improving the native cattle :—

(i) By selection.

(ii) Grading up native stock with imported cattle.

(iii) Breeding crosses of native and European cattle.

(i) He emphasises that this method is slow. He also points out the practical difficulties of training the cows to give down their milk when not being suckled.

(ii) Experience has shown that "grade" cattle tend to suffer from constitutional disabilities in the same way as pure bred European cattle. Of the breeds tried Shorthorn and Ayrshires have been the least satisfactory, while Friesian, Jersey and Red Poll have been more adaptable. This method is not considered to produce a solution to the problem of breeding up cattle in the tropics.

* The paper is reproduced in full in another section of this number of the M.A.J.—Ed.

(iii) Crosses have been produced with the constitution of the native cattle and the udder development of the European cattle.

Such points as colour and horns segregate sharply among the progeny of inter-bred first crosses, but points as body form and milk yield segregate about a mean so that it might be possible to produce a new breed with a higher milk yield, suitable for tropical conditions. To achieve this only one breed of native cattle and one of imported cattle would have to be used. It would also be necessary to have a number of herds to prevent excessive in-breeding.

Discussing the question of marketing he records that the use of cold stores and ice makes the milk too expensive for the majority of the native population. He suggests that pasteurisation and bottling would be a cheaper method of ensuring a safe milk supply.

Summary of Papers.

The papers dealt mainly with the problems to be met with in tropical dairying. It is only in India that the work has been going on long enough for any conclusions to be reached.

The main agricultural problems are :—

- (A) The breeding of a type of cattle which has a profitable output of milk and is at the same time resistant to tropical diseases.
- (B) Secondly, to grow such crops as will economically maintain the full milk yield of the cows.
- (C) Another problem, which is partly agricultural, is the packing and transport of milk from the dairies to the urban population.
- (A) Selection of suitable cattle. The two most usual methods are —
 - (i) Importation of high yielding cattle from temperate countries and (ii) grading up, by selection, of indigenous cattle.
 - (i) This method has been tried with varying success in all the countries reported on. In India it is not considered satisfactory, but the preliminary work in the West Indies indicates that it shows promise in that area.
 - (ii) This slower method has only been systematically tried in India, where the results are satisfactory. The weight of opinion appeared to be in favour of this method.
- (B) The growing of special crops for fodder was not considered. The advantage of making young grass into silage as against allowing the grass to grow old and fibrous was reported.
- (C) The use of refrigerating vans or ice, for the transport of milk, makes it too expensive for the majority of the population. Pasteurisation and dispatch in sealed bottle is suggested as a more economical method.

Danish National Dairy Exhibition.

The main feature of the exhibition was the collection of samples of butter and cheese which had been submitted for competition. The exhibits of butter, which numbered 1,400 barrels, were all displayed in a refrigerated enclosure, with glass windows. In front of each barrel was a sample from which visitors

could take small portions to taste. The evenness and high quality of these samples was very noticeable and it required a trained palate to differentiate between them.

The remainder of the show was taken up with exhibits of the various makes of Danish agricultural machinery. One striking feature was the number of refrigerating plants to be seen. Some of these were worked by ammonia and others by carbonic acid. The plants were exhibited in all sizes. These appear to be more used in the inland continental countries, where the climatic conditions are more extreme than in England. Owing to the long coast line of Denmark, that country is warmer on the average than other countries in the same degree of latitude. The winters, however, are long, from 7 to 8 months, so that at the most there are only five summer months.

Practically every machine which was used for measuring or manufacturing a product, was fitted with a sloping bracket. These were fixed at a comfortable height for writing and in such a position that the operator could conveniently read the dial on the machine and then write down his record; a point which must both facilitate the recording and tend to render it more accurate.

On the stalls devoted to the exhibition of milk containers, the general use of aluminium was very noticeable. In almost all cases this metal was used for milk churns, usually for milking buckets and other small vessels as well. The churns are seamless and hard rolled. The advantages of having a rustless metal are numerous. One firm exhibited a churn fitted with an ice container in the neck.

The bottles used for the retail distribution of milk all had much smaller necks than those customarily seen in England or Malaya, the size at the top being smaller than a one cent piece. In place of the pressed-in parchment seal, metal crown covers were generally used.

One firm exhibited flasks fitted with special stoppers that automatically measured off the amount of sulphuric acid and amyl alcohol required for the Gerber's method of testing the butter fats in milk samples.

The machine for weighing eggs was similar to those seen in England in that each egg was fed from a travelling band on to a revolving table, from which the heaviest eggs were thrown out by the first balance and the lighter ones in rotation. It was, however, claimed that the machine there damaged less eggs than any other that is being manufactured at present.

A number of different types of pasteurising machines were also exhibited, which was to be expected as practically all the milk in Denmark is treated in this way before consumption.

Other machines seen were churns, butter workers, separators, washing, bottling and corking machines.

Selected Article.

TROPICAL DAIRYING PROBLEMS*

Feeding Problems.

Things which have a seasonal distribution have also a geographic range, and an interesting comparison can be made between the seasonal variation and geographic differences in milk yields. Sanders has investigated the seasonal variation in the yields of cows in two different districts in England, which show that on the average in commercial herds, the yield rises at the time the grass begins to grow in the Spring and falls again as the hot weather begins and the grass matures and becomes fibrous. Woodman's work on the composition of grass has shown that in the early stages of growth it is a concentrated food (plus water) and that its high protein content, high digestibility and low fibre content makes it a very suitable food for milk production purposes. As the grass gets older, however, and especially after the flowering shoots appear, lignified fibre is formed, the proportion of protein and the digestibility fall and the bulkness is increased. Thus even in England where the supply of concentrated foods is abundant, commercial herds on the average show well-marked seasonal changes due to the type of roughages fed, for a large proportion of the cow's food intake in commercial production always consists of home-grown forages or grazing. High producing animals have not the capacity to hold the bulk of food required to supply sufficient nourishment to support high yields where the feeding stuffs are of low quality and contain much fibre; this is the main cause for low yields under commercial conditions.

The seasonal variation in the milk yields will then give a measure of the feeding value for milk production of the forages used during the different months of the year. These have been calculated from milk records obtained under tropical conditions in Jamaica and Trinidad: the yields of milk are low during the "dry season" (December to March) and rise with the onset of the "wet season", but begin to fall again before the end of the wet season. A comparison with the seasonal variations in England shows that the primary influence is, as stated above, the amount and quality of the grasses and forages for a comparison with rainfalls and temperatures shows that, while in the Temperate Zone the growth of grass in the Winter months is limited by temperature and begins as this rises in the Spring (rather earlier in the South-Norfolk, than in the North-Cumberland), in the Tropics the growth of grass is limited by rainfall and begins with the onset of the wet season, and is reduced during any intervening short dry period.

That these seasonal differences in milk yields are due to the effects of climate on the plant and so on the nutrition of the cow (in addition to any direct action the temperature or rainfall may have on the animal) is also shown by the fact

* By John Hammond in *Tropical Agriculture* Vol. VIII, No. 12, December, 1931.

that in Jamaica during wet "dry seasons" (1925, 1927) the yields are much above those in dry "dry seasons" (1926, 1928).

Thus the main problem of feeding in the Tropics would appear to be the supply of high protein, low fibre and if possible, succulent foods during the dry season. Ensilage of grass or forage crops in the early stages of growth in either the tower or pit silo, or irrigation of pastures are methods which are being used with success. Forages on the whole in the Tropics, like those in England during the hot weather, soon develop fibre and become bulky and unsuited for milk production. Much variation exists, however, among the different grasses and there is much scope for the selection of low fibre and high protein species. Digestibility trials of those in common use, are also now being made at the Imperial College of Tropical Agriculture in Trinidad. In the Temperate Zones, the deep rooting and high protein leguminous plants such as lucerne and white clover supply a high protein feed during the Summer months and these not only supply suitable food for growing and milking animals but also raise the fertility of the soil by fixing nitrogen. At present no such leguminous crops are cultivated in the West Indies, and the discovery and use of such would do much to improve cattle production in the Tropics.

While deficiencies of home-grown forage crops for high milk production can be made up in European countries by the use of the comparatively abundant bye-products of industrial manufacture (oil cakes, meals etc.) and in Temperate Zone by the rotational cereal (oats) and pulse (bean) crops grown, these products are difficult to obtain and are expensive in the Tropics. The local production of coconut meal may in the future supply such a product, but the prevailing tendency in the West Indies for the cultivation of trees and perennial crops to the exclusion of annual crops (which is encouraged by the nature of the climate) will always limit the local supply of concentrated feeding stuffs of this nature and render their importation necessary for high production. One of the functions of the animal in agriculture is to form a means of cashing those crops, or bye-products of crops, which are not fitted for human consumption direct. Of the staple crops which are grown in the West Indies, the sugar cane is almost the only one which supplies such bye-products suitable for feeding cows: the tops in the cutting season and the molasses form useful feeding stuffs and a variety called Uba cane which produces an abundance of leafy growth, is particularly valuable for this purpose. A peak in the milk production curve about February in Trinidad is probably due to the use of these fresh cane tops during the cutting season. It is necessary that improvements in feeding should go hand in hand with breeding, for unless this is done the nutrition will either limit the yield of cows with high milk capabilities or undermine their constitution so that they die at an early age.

Management.

The problems of management vary greatly in different districts according to the availability of pasturage, etc. and the details, although very important, can only in a few cases be drawn into general statements. Under natural condi-

tions cattle graze in the early morning and evening and lie in the shade during the middle of the day when the sun is hot. Housing during this part of the day not only falls in with this natural desire for shade but allows of the feeding of concentrates according to yield and may be used to increase the intake of water (by the addition of a little mollasses to it: and concentrates if in meal form may also be fed in this way). Provision of shade, and so the continuance of feeding throughout the day, is in some areas in Jamaica obtained by the use of the Peruvian rain tree (*Pithecolobium saman*) which allows grass to grow under it: a combination of these trees with small wired-in paddocks receiving water from neighbouring irrigated land and managed by a system of rotational grazing, appeared to give excellent results during the dry season.

Breeding.

Cattle in the Tropics have not been improved to the same extent for either milk or meat production as they have been in the Temperate Zone. From time to time importations of South America, European and Indian (Zebu) cattle have taken place and the present native stock, the survivors of these various importations, is very mixed. Various methods of improvement have been tried and the following are the main conclusions reached:

(a) *Selection of Native Stock.* This method is very slow. Great difficulty is experienced in breaking in the animals to be milked: having been used mainly for work purposes, they do not let down their milk unless a calf is being suckled or other means are taken and they frequently fail to breed again until the calf is weaned or the milk yield falls. Possible methods of overcoming this difficulty are the haltering of young stock to induce docility and the selection of sires from docile dams. The method of selection of this stock would, however, prove slow although not impossible.

(b) *Importation of European stock and grading up of native stock with these.* At first very good results were obtained by this process but just as it is found difficult to keep and breed pure European stock in the Tropics commercially because of a variety of causes which require further study and analysis (disease resistance, heat regulation, etc. but summarized as constitutional disabilities) so the stock which had been graded up by the use of European bulls for three or more generations fail to produce much milk and became degenerate. Table I for example, shows that in the Tropics a very well-bred Guernsey bull used on high grade European cows reduced rather than increased the milk yields.

TABLE I.

Progeny of Guernsey bull used on high grade European cows		
<i>Corrected Mature Milk Yields</i>		Lb.
Average of 11 dams	...	5,200
Average of 11 daughters	...	4,800
		<hr/> 400 <hr/>

Of the various European breeds tried, the Shorthorn and Ayrshire appear to have a constitution least suited to the Tropics and signs of degeneration appeared at a lower concentration of their blood than those of other breeds (Friesian, Jersey, Red Poll) more adaptable to Tropical conditions. It would appear that a long thick coat and white skin are inimical characters in the Tropics. Periodic clipping is essential for the health of such animals. The methods of importing pure European stocks and the grading of native cattle to such stocks appear to offer no solution of the problem of breeding commercial dairy cattle in the Tropics.

(c) *European cattle—Zebu crosses.*—The Zebu has been very little improved for milk production and has a poor udder development, but it has a constitution eminently suited to the Tropics. On the other hand, European cattle have a well developed udder, but their constitution is unsuited to the Tropics and for this reason the body is not sufficiently vigorous under commercial conditions in the Tropics, to support the udder and high milk production. Crosses between the two types, however, have both constitution and udder development and so give better production particularly life production than the pure breeds. This is not merely a matter of hybrid vigour for different European breeds crossed together in the Tropics give no better results than those breeds when pure. On the other hand, it was surprising to find that the use of a pure Zebu bull on high grade European cows (although he came from a lower milk yielding strain) increased instead of lowered the yields. (See Table II).

TABLE II.
Progeny of Zebu (Montgomery) bull used on high grade
European cows

<i>Corrected Mature Milk Yields.</i>		Lb.
Average of 10 dams	...	4,730
Average of 10 daughters	...	5,700
		<hr/>
		+ 970

It is believed that both constitution and udder development are multiple factor characters in inheritance and this being so it would follow that, cattle having many chromosomes, the inheritance of these characters is fairly accurately described by Galton's law of blending inheritance or percentages of blood. If this is so the first point to determine is what proportions of Zebu and European blood give the best results under any climate conditions. According to results obtained in Jamaica $\frac{1}{4}$ to $\frac{1}{2}$ of Zebu blood appears to give the best results. Conditions, here, however, are not so severe as may exist elsewhere in the Tropics, where a higher proportion of Zebu blood may be required. These results are taken from lactation periods in the years 1923-28 only and probably a more certain estimate of the proportion of Zebu blood best suited to commercial milk production would be obtained if the life production of the different grades were considered. As the proportion of European blood is increased from half to three

quarters and seven-eighths so the average lactation yield will go up, but the cows do not last so long in the herd and their life production becomes less. Promiscuous and repeated cross-breeding, however, does not lead anywhere, although the trial of the different European breeds has been necessary in the beginning to find out which were best. Once this is determined it is better to keep to one breed and its crosses with the Zebu and avoid that promiscuous mixing of breeds which leads only to mongrels.

Although the fancy points such as colour and horns segregate sharply when the first crosses are bred together there is every indication that the commercial qualities of constitution, body form and milk yield (which appear to be multiple factor characters) do not segregate sharply and only vary about a mean. If this mean produces a profitable commercial animal, the numbers to be weeded out will, therefore, be small, and there would appear to be no reason why a new breed of dairy cattle suited to the Tropics should not be produced by breeding together whichever grade of Zebu-European cross give the best results in a district. The Suffolk, Dorset Down and Corriedale breeds of sheep have been produced in this way.

The evolution of such a new breed could best be obtained by its being adopted on a large scale in a given area, so as to allow of interchange of blood between herds; and by the formation of a herd book which would act by segregating such animals from the common stock, a primary necessity in the creation of a new type. As with European cattle the chief difficulties would be met with the bulls; the cows could be selected on their milk yields but the bulls could only be selected by progeny tests.

Marketing.

The high temperature in the Tropics make this a troublesome matter; for without precautions the milk would not keep sweet long. Consequently it is found that, as in England many years ago the family cow is kept in towns and forage is brought in to feed her. Town dairies, where only a few hours elapse between milking and consumption are also numerous; but such milk is comparatively expensive to produce, due to the high cost of the land and the transport of food. Town dairies in Great Britain have almost disappeared since the pasturage of milk has been adopted. In the West Indies, clean milking, cooling, bottling and keeping the cans in cold storage and ice are being used in some districts, but these methods are comparatively expensive and while the extra cost is willingly paid by the European population the price is too high for the large proportion of the native population. As in Great Britain it would appear that pasturage and bottling would afford the best means of ensuring a safe and cheap supply of milk for the bulk of the population. Such a process would, as it has done in England, extend the radius from which a town would collect its milk supply.

Reviews.

Soil Conditions and Plant Growth.

BY

E. JOHN RUSSELL.

New (Sixth) Edition, 621 pp., Longmanns Green & Co.

London — 21 shillings.

A new edition of what has come to be regarded as the standard work on soil science is always of interest.

The sixth edition has increased in size by a fifth, though the number of chapters and general treatment has not been altered, the contents have been enlarged and re-arranged in several cases to bring it in line with the latest information.

In the first (Historical and Introductory) chapter there is naturally but little change but Chapter II (Soil Conditions affecting Plant Growth) shews many alterations and has been increased in size by one third. This increase is due largely to fuller treatment under the heading "Foods" (nutrients), the sections on Nitrogen, Phosphorus, and Potassium being more than doubled. The order of sections has been improved, the physical factors of the unalterable type (water, temperature, climate and light) being grouped together at the commencement. Of minor importance but of convenience to the reader is the heavy type headings dealing with each nutrient as against the old italics at the commencement of a paragraph.

Chapter III (The Composition of the Soil) has been most completely re-arranged, in fact may be said to be largely re-written. An entirely new section has been added on that infrequently understood subject "Soil Structure". The portion of the chapter dealing with clay has been considerably changed. It will probably be a relief to tropical workers that the opening paragraph of the chapter in the previous edition which read—"It is well known that only the top six or eight inches of the soil is suited to plant life"—has now been omitted.

With Chapter IV a change in title occurs in the latest edition, being "Changes in Mineral Composition" as against the old "Chemical and Physical Relationships of the Soil". There is also a marked change in treatment and the influence of the Russian School is obvious throughout the chapter. To the tropical reader it will probably seem that most of the detail is concerned with temperate soils, though this may be ascribed possibly to dearth of general tropical soil literature. The perennial controversy on the subject of "Laterite" is again raised.

Chapter V deals with "Changes in the Organic Matter", a subject brought into both Chapters IV and V in the old edition, though being dealt with chiefly in Chapter V in each case. On the whole the lines of the previous editions are closely followed though sections generally are rather fuller. One is rather left

with the feeling that some of the subject matter would go better in Chapter VI "The Micro-Organic Population of the Soil and its Relation to the Growth of Plants". In this latter practically no changes seem to have been made though two short sections have been added on Worms (Nematodes) and Microbiological Analysis of the Soil.

The chapter that follows (The Biotic Conditions of the Soil) has been but little changed though slightly enlarged.

The eighth chapter (The Soil in Relation to Plant Growth) follows previous editions for the first few pages, but the section on Humus Soils has been re-written and may be said to be treated by the latest method of classification. The chapter as a whole is probably the most interesting in the book to the general agricultural reader for here at any rate the soil is dealt with as the media of crop growth. There is much that is new towards the end, chiefly in discussion of agricultural and ecological relations of soil analyses. A number of sections previously in Chapter IX have now been brought forward to Chapter VIII.

The ultimate chapter (IX) has changed its title from "Methods of Soil Examination" to "Methods of Characterising Soil" and it definitely leaves the feeling that the writer's attitude has changed and he has taken up the detached standpoint of the Soil Scientist as opposed to the practical point of view of the agricultural worker who not unnaturally regards the soil as a medium for plant growth rather than a study "per se". "To aid agricultural experts, to advise farmers" no longer appears in the list of reasons for soil examination.

The Appendix on Methods of Soil Analysis has been brought up to date by the substitution of the International Standards for the British ones in Mechanical Analysis. A detail of Thornton's method for examination of bacterial numbers has been added.

To summarise, the new edition may be said to be well worth the guinea now charged for it.

J. H. D.

Tenth Report on Native Rubber Cultivation in Netherlands India.

First Quarter 1932.

Prepared by the Bureau of Agricultural Economics' of the Division of Agriculture of the Netherlands India Department of Agriculture, Industry and Commerce at Buitenzorg, Java, May, 1932.

The report gives a general review of rubber cultivation and production for Netherlands India for the first quarter 1932, prefaced by a few additional remarks regarding 1931 production. From data received subsequent to the publication of the Ninth Report it is concluded that the total export of rubber from the Outer Provinces in 1931 was 89,836 metric tons. *

Turning to the review of the first quarter 1931, price fluctuations are detailed. The continued decline in price is noted, while it is pointed out that

the decision reached by three interested governments against the introduction of rubber restriction was probably expected as, while prices declined considerably before the announcement, it is significant that prices did not drop much further following the official announcement.

The fall in price in the second half of January did not materially influence exports, probably on account of the native need of money in connection with Mohammedan festivals. The reaction took place in February, when exports decreased by about 1800 metric tons. Prices declined still further resulting in a decline in exports by another 500 metric tons. The total exports of native rubber (dry equivalent) from the Outer Provinces during the first quarter 1932 amounted to 15,942 metric tons, as compared with 23,160 tons, 25,180 tons and 26,207 tons for the corresponding period of 1931, 1930 and 1929 respectively.

"The figures shew clearly how markedly the export reacts nowadays to price fluctuations. On a proportionate basis, the export has declined even more than the price. From January until April, 1932, the latter shews a decline by nearly 40 per cent. whereas in the same period the export decreased by about 48 per cent. Whether this points to the fact that the point has been reached when the population will stop tapping rubber more or less permanently cannot yet be stated. In the event that prices remain at their present level perhaps the next few months will bring some light on this point."

The last part of the Report gives some details of the present conditions of the industry in the various rubber-producing regions of the Outer Provinces, and adds emphasis to the conclusions stated above.

D. H. G.

The Waste Products of Agriculture.

Their Utilisation as Humus.

Howard and Wad. Oxford University Press 1931. 7s. 6d.

116 pp. 4 Appendices. 14 plates, 9 figs.

Throughout this book the authors stress the importance of organic material to the soil. They point out that this factor has been overlooked to some extent in the West as a result of the introduction of artificial manures, though subsequent investigations of soil microbiologists have led to a renewed realisation of its value.

They state also that in the East the principle of organic manuring has always been upheld and the use of artificials has never found favour. In consequence of this, great importance has always been attached to composts. Centuries of experience in the preparation of these has led to methods of procedure for which scientific explanations are only just forthcoming.

The practice of the East is to prepare the compost heap outside the field and later at a certain stage of decomposition to apply it to the land. The

scientific explanation of this is that the soil is thus spared the immediate consequences of the fierce initial reaction of decomposing vegetable matter and is later enriched by the products of a slower and more even decomposition. Hence the authors question the advisability of the increasing practice of green manuring and suggest that although it may supply the more immediate humus need of eroded and poor soils, it is to a degree harmful and certainly wasteful.

Thus they introduce us to the process adopted in Indore for the manufacture of humus. This process is in effect the treatment of vegetable wastes with cattle dung and urine.

About half the book is devoted to a detailed description of this process and great emphasis is laid on such factors as moisture content, aeration and correct mixing of the vegetable debris. The success of the process depends upon the correct fungoid and bacterial infection of the compost heap which is accomplished in the first place by means of cattle dung and at a later stage by inoculation with partially decomposed material.

In Indore the vegetable wastes from 300 acres of land were converted into humus by means of half the urine-earth and one quarter the cattle dung from forty oxen.

The process seems simple and clean and provided a small quantity of cattle dung and urine is available should be capable of easy adaptation to existing local conditions.

In this connection, however, two points of importance which are not dwelt upon by the authors would be: firstly, the amount of labour required and secondly, adequate and trustworthy supervision.

R. G. H. W.

Coffee Planting in Kenya Colony.

BY

F. H. SPROTT.

*Printed by the East African Standard Ltd, Nairobi, 104 pages and index,
4 half tones and 15 line illustrations.*

The coffee industry in Kenya, in spite of severe competition, has made rapid strides during recent years. Progress since 1914 has been constant and at the present time the high quality and reputation of Kenya coffee in the world's markets is established. The fall in price of low-grade coffees affects generally the prices of high-grade coffees, but owing to its special characteristics of liquor and appearance, Kenya coffee is likely to maintain a premium in the London market. According to the Annual Report of the Department of Agriculture, Kenya, for the year 1930, the total area under coffee early in 1931 is returned as 96,689 acres. During 1930, 15,508 tons of coffee were exported, valued £1,477,586, representing 46.8 per cent. of the total value of the agricultural exports of the Colony.

The book under review is a revision of a previous publication written by the author several years ago. It aims at supplying coffee planters with a conspectus of Arabian coffee cultivation as undertaken in the Highlands of Kenya. The ordinary limits of altitude between which coffee is grown lies between 5,000 and 6,500 feet. The variety of coffee mainly grown in Kenya is the 'Bourbon' or African Mocha type of *Coffee arabica*, with which the majority of estates are planted. During recent years three other types of *C. arabica* have been introduced, namely Blue Mountain, Kent's Hybrid and Jackson's Hybrid.

The book is divided into four parts. Part I deals with local conditions of particular interest to prospective planters. A summary of capital expenditure for the first four years and subsequent estimated revenue is included.

Part II contains a clear account of the details of Arabian coffee cultivation. With fresh seed and favourable conditions a high percentage germination within eight weeks is obtained. When the cotyledons of the seedlings have opened and the first pair of leaves are showing, they are transplanted from seed beds into nursery beds. Those seedlings having a long and slender tap-root require special attention, all such taproots being cut back with scissors or a sharp knife. The seedlings are usually planted about eight inches apart and remain in the nursery until they are fifteen to eighteen months old before planting in the field. Various planting distances are adopted, the average number of bushes per acre being 550, obtained by spacing the bushes 8 by 10 feet apart. Due stress is made of the vital importance of planting the seedlings with an unbent taproot. A series of line drawing illustrate necessary pruning of twisted roots before transplanting is undertaken. Ball planting is referred to and is shown to be advantageous where the nursery is near the area to be planted. The loss of surface soil from erosion is evidently a problem in Kenya, as in Malaya. Three preventive systems are in use namely, catch pits with silt thrown back uphill, contour trenches, and low fences of interwoven brushwood.

Opinion is divided as to the value of shade trees. A number of the more common trees employed as temporary and permanent shade are described. The value of leguminous cover plants, during early stages, is emphasized.

Organic manures and chemical fertilisers are commonly used. Methods of preparing pulp compost are explained and the importance of returning all residues to the land is pointed out. The usual applications of organic manures *e.g.* guano, bone, blood and fish meals, are about 4 to 5 cwt. per acre. Information, however, regarding the use of chemical fertilisers is both scanty and elementary.

A number of pruning systems are practised. The single system was originally the most popular in Kenya, but it is now losing ground to the multiple stemmed system, the change being due, to a certain extent, to fears of labour shortage. It is generally claimed that the earliest and heaviest crops are obtained by the single stemmed system. Cropping operations require unremitting vigilance and only ripe cherries should be picked. The average ratio between fresh cherry and cleaned coffee is 6.5 : 1.

Average yields of coffee per acre are as follows :—

<i>3rd. year.</i>	<i>4th. year.</i>	<i>5th. year.</i>	<i>full bearing.</i>
1 cwt.	4 cwts.	7 cwts.	$\frac{1}{2}$ ton.

Pests and diseases are dealt with in considerable detail in Part III. Coffee is very liable to damage from insects and disease and the importance of periodical inspection of estates by the staff of the Department of Agriculture under the Diseases of Plant Prevention Ordinance is emphasized.

Part IV is concerned with the preparation and marketing of the crop. The various operations in the preparation of coffee are described, namely—pulping, fermenting, washing, drying, hulling, grading, bagging and marking and shipment and marketing. Mechanical dryers are used on the large estates. Parchment coffee has been made in Kenya recently. At the present time local factories undertake the treatment of parchment coffee for small estates unable to afford the capital for a complete factory.

The book contains much useful information and should be of particular value to the practical planter undertaking the cultivation of Arabian coffee at high altitudes in the tropics. It forms a good companion to "*Coffee Growing, with special reference to East Africa*" by J. H. McDonald, published by East Africa, Great Titchfield Street, London. The latter book is, however, more comprehensive in its outlook.

J. N. M.

Miscellaneous Article.

THE NINTH MALAYAN EXHIBITION.

Taking into consideration the depressed condition of the times, the exhibition organised by the Malayan Agri-Horticultural Association in Kuala Lumpur on July 30th to August 1st, proved a surprising success.

The weather throughout the period was excellent and the official return of attendance for the duration of the exhibition was 23,177 as compared with 24,139 for the previous year.

The Opening Ceremony.

After a preliminary speech by Mr. F. W. Douglas, President of the Malayan Agri-Horticultural Association, the exhibition was opened by His Excellency the Governor and High Commissioner, Sir Cecil Clementi, G.C.M.G., and the occasion was honoured by the presence of His Highness the Sultan of Selangor and His Highness The Yang di Pertuan Besar of Negri Sembilan.

His Excellency in his opening speech commented on the generally improved political and financial outlook of the home Government which it is hoped, will react favourably on local trade conditions. He announced the authorisation of a waiver on the part of the Federated Malay States Government of all quit rents in excess of \$2/- an acre as a temporary measure of relief to Malayan agriculturists, adding that this waiver will apply only to current rents and not to arrears carried over from last year. His Excellency reiterated the urgent necessity for the country's becoming self-supporting as regards its food supplies, quoting figures of the 1931 imports amounting to a total value of \$76,071,000 in proof of its present dependence on foreign countries.

Referring to the rice industry, His Excellency spoke of the importance of increased stimulation of interest in this crop and of the many measures which are now being taken to further this, such as the work of the recently constituted Irrigation and Drainage Department, the efforts of District Officers and Agricultural and Co-operative Officers to assist the extension of areas under rice, and the establishment of padi breeding, test and experimental stations, both as a means of technical investigation and as centres for the distribution of improved strains of seed, the proof of the efficacy of these measures being shown in the fact that in 1931 the area under rice exceeded that of the preceding year by 58,000 acres *i.e.* a 10 per cent. increase.

His Excellency referred to the rice shortage of 1919—21 during which the Government alone expended forty million dollars in augmenting supplies, a sum which could not possibly be found at the present time, as a warning of the dangers of Malaya's not being self-supporting in her staple crop.

On the subject of copra, His Excellency mentioned the very satisfactory results obtained from the efforts made in the Districts of Kuala Selangor and Kuala Langat, under the guidance of the Department of Agriculture, to improve

the methods of preparation and marketing of the small-holders' product. The recent development in the local cultivation of tea, more especially in the Cameron Highlands, and the effect that these are likely to have in reducing imports were mentioned in his speech.

The pineapple trade, he stated, was worth about £1,000,000 a year to Malaya, but the economic conditions of the trade and the quality of the fruit still left something to be desired. He referred to the recent duties imposed on Malayan pineapples under the new Canadian tariff, which have had the effect of excluding this product to a large extent from the Canadian market and announced that the question of these duties will be brought up at the Imperial Conference at Ottawa this month, when the Australian Government will be asked to agree to a reduction of the Canadian duty, and that a representative of the industry from London will attend this Conference in order to advise and assist the Colonial Office representatives in negotiations concerning the pineapple duty.

His Excellency concluded his speech by laying stress on the importance of developing the production of other staples for domestic consumption, more particularly, fruit, vegetables, poultry and tobacco, and on the great stimulus to popular interest which is aroused by exhibitions of such products.

After His Excellency had declared the Exhibition open, Dr. H. A. Tempamy, Director of Agriculture, S.S. and F.M.S., gave a short address in which he emphasized His Excellency's pronouncement regarding the importance of lessening Malaya's dependence on imported foodstuffs and other staples. Dr. Tempamy highly praised the response made by exhibitors and organisers of the exhibition, quoting it as proof of the general appreciation of its potential value.

Lack of space forbids highly detailed particulars of each of the various exhibits.

Sections of the Exhibition.

The Agricultural show was divided into the following sections—Fruit, Vegetables, Cereals, Oils and Fats, Fibres, Horticulture, Poultry, Pigs, and Confectionery. The non-agricultural sections were—Village Industries, Malay Schools, Weaving and Needlecraft, Art and Photography and Trades.

The following Institutes and Government Departments had set up special exhibits—Department of Agriculture, Rubber Research Institute, Drainage and Irrigation Department, Fisheries Department, Survey Department, Electrical Department, F.M.S. Railways, Public Health and Infant Welfare Departments and the Town Planning Department, also the Co-operative Department gave displays of educational cinema films.

Competitive Sections.

The exhibits in the competitive sections were of a high standard of excellence and many in number. Some of the copra produced by small-holders was of a hitherto unequalled quality. The cereal section contained very many samples of rice and padi from all parts of the country; the District of Balik Pulau, Penang,

alone had 900⁶ entries, with a gratifying increase in the number originating from selected strains derived from the Department of Agriculture. The quantity and quality of entries in the fibre and kapok classes was remarkable.

The fruit and vegetable sections contained very many more exhibits than last year and the excellence of the material was a proof of the vastly increasing interest taken everywhere in the cultivation of these crops. The pig show was decidedly the best which has yet been displayed at the exhibition: as well as the fine examples of pedigree-strain animals from the Government Experimental Plantation, Serdang, there were many excellent specimens of pigs bred by Chinese, the majority of which were cross-breeds from Serdang stock with the local "Poland China" type.

The Horticultural section made a very effective display among which were many exhibits of flowers from Fraser's Hill.

Department of Agriculture.

The Agricultural Department's exhibit contained several new features this year, notably pepper from the Government Experimental Plantation, Serdang, and tea, potatoes and rhubarb from Cameron Highlands; also specimens of locally grown tobacco leaf were displayed for the first time. The samples of prepared leaf grown by Chinese and Malay small-holders, some artificially and some sun-cured, were principally of the Deli variety; there were also a few exhibits of Rangoon, Chinese and Virginian leaf. The latter grown at the Government Experimental Station at Singapore could not be said to compare very favourably with the specimens of Virginian leaf imported from America by the British American Tobacco Co., which staged an exhibit of leaf, cut tobacco and locally made cigarettes, by the side of the locally grown tobaccos for the purpose of comparison.

In general, the small-holders' tobacco was not of a very high quality, showing as it did in most cases a great deal to be desired in the methods by which it had been cured. Sliced tobacco and cheroots of local manufacture were also displayed.

The exhibit of made and packed tea from the Government Experimental Plantation, Serdang, was particularly interesting, and showed a considerable improvement on that displayed in the previous year; it is noteworthy, in this connection, that among the competitive exhibits section there were more than 100 samples of tea grown and prepared by small-holders.

A very instructive stall devoted to copra was staged by the Department of Agriculture in which many samples of badly prepared copra were set out for comparison with those of locally prepared material of Ceylon Standard Quality. Examples of all the common faults in preparation were displayed together with instructions as to how these should be rectified. A section was devoted to bacterial moulds and the ravages of insect pests in the badly prepared article, while the comparative immunity of correctly prepared copra was conclusively demonstrated.

Displays of pedigree strains of padi and of coconut selection work were also included in the Department's section.

The Rubber Research Institute of Malaya.

The Rubber Research Institute of Malaya staged very comprehensive exhibits of all branches of their activities, among which were the root systems of various cover crops, specimens of root diseases of the rubber tree, *Oidium Hevea*, the treatment of pruned stocks and demonstrations in bud-grafting on living seedlings. One section devoted to locally manufactured latex products contained, notably, some rubber-bound paints and distempers and a product known as 'Crumb Rubber', a non-cohesive rubber powder either vulcanised or unvulcanised, which can be put to innumerable uses, among which is the admixture with concrete. It is prepared by the isolation of the lipins—chemical substances closely allied to the higher fatty acids—from the serum of latex and their incorporation in fresh latex in a higher quantity than is normally present, thus destroying the cohesive property of the prepared rubber.

Other Government Departments.

The Drainage and Irrigation Department staged a scale model of the extension of an irrigation and drainage scheme covering an area of 5,000 acres at Sungei Manek near Teluk Anson.

The Pavilion devoted to the exhibits of the Public Health and Infant Welfare Departments contained much educative and interesting material among which were models demonstrating anti-malarial precautions in villages. The school and villages industries sections attracted considerable attention, the basketry in the former attaining a high standard of workmanship. It is noteworthy that the products of village handicraft were almost entirely ornamental rather than useful. Port Dickson basket work, silver-ware and sarongs from Kelantan and Brunei in Borneo, had each a stall of their own and a small exhibit of village agricultural produce from Kelantan was also included.

Trade Section.

It was gratifying to note that the exhibits in the trade section showed no falling off since last year, while there was a marked increase in the number of Malayan produced goods. Among the trade stands containing exhibits of materials of service to local agriculture were those of locally made bricks and plywood, concrete, rubber milling machinery, rubber bud-wood from Malayan clones and chemical fertilisers.

A notable innovation among the non-agricultural stalls was that of Malayan pewter-ware, in which many attractive exhibits of ornaments and utensils made of locally manufactured pewter were displayed.

The exhibition proved itself financially successful and both exhibitors and organisers are much to be congratulated on the results of their labours which cannot fail to have created a very considerable stimulus to agricultural development.

Departmental.

FROM THE DISTRICTS.

The Weather.

Throughout the greater part of the Peninsula the weather during the month was hot and dry. In Northern Kedah, however, the rainfall was good and well distributed, while in the Seremban and Port Dickson Districts of the Negri Sembilan, in parts of Johore and in Singapore Island there were showers of which some were very heavy, amounting in parts of the Negri Sembilan to over five inches in one day. In Kuala Lipis and Raub Districts of Pahang showers occurred only during the first half of the month, while in Malacca there was a spell of wet weather in the middle of the month.

Remarks on Crops.

Rubber.—There was a slight rise in the price of rubber during the month. Smoked sheet from small holdings sold for \$3.90—\$7.60, unsmoked sheet for \$3.00—\$6.00, scrap and lump for \$1.00—\$4.00 per picul. In Singapore the corresponding prices were respectively \$7.30, \$6.50 and \$3.00 per picul.

The rise in price was not, however, sufficient to cause any change in the general situation as compared with that obtaining in June, more especially since many owners of small holdings were engaged in padi planting operations, attention to supplementary food crops or the harvesting of fruit.

In parts of Perak and Pahang a second wintering caused by the dry weather was recorded.

Padi.—The price of padi showed little change, ranging between 6 and 15 cents per gantang.

Planting operations proceeded normally in most parts of the Peninsula, but were delayed in Province Wellesley by dry weather throughout the month and in Krian towards the end of the month.

In Selangor the inter-season crop made good growth and gave promise of satisfactory results, while in the areas along the Pahang river the early planted crop also did well on the whole, though in Temerloh District it suffered somewhat from drought.

In the new padi areas of Tanjong Karang and Panchong Pedena in Kuala Selangor District good progress was made in felling jungle and work on the drainage schemes was commenced.

The total distribution of pure strain seed in Malacca amounted to 2,924 gantangs at the end of the month. In Larut District 230 gantangs of pedigree seed were distributed.

Coconuts.—Preparation of copra by Malays continued to make good progress in the coastal Districts of Selangor and in Bagan Datoh sub-District of Perak.

Purchasing by European planters has improved the market for copra at Sabak Bernam, while Malays in Bagan Datoh have obtained a better price by selling direct on the Penang market. In many parts of the country, however, there is still room for considerable improvement in marketing facilities.

Recent tours of the Rural Lecture Caravan in the copra producing areas in Penang Settlement and the States of Perak and Selangor have had a very definite effect in rousing Malay small-holders of coconut land to a realisation of the possibility of obtaining a better return from their properties.

The price of copra improved slightly, ranging from \$3.80—\$5.50 per pikul for the first quality.

Tobacco.—There was an extension of the area planted with tobacco in Kedah, Province Wellesley and Selangor. In the Province interest in this crop appears to have revived.

Prices for the better quality leaf ranged from \$25—\$32 per pikul, but were as high as \$40 per pikul in Penang. Second quality leaf sold for \$10—\$20 per pikul. Locally prepared cut tobacco sold for 90 cents—\$1.60 per kati in Selangor, 40—90 cents per kati in Negri Sembilan and 90 cents—\$1.28 in Pahang.

Tea.—Interest in this crop among Chinese small-holders in Selangor is steadily reviving owing to the increased yields obtained through better methods of cultivation and pruning at Sungei Balak. Some Chinese headmen in other areas, especially at Bukit Kapar in Klang District, have laid down small nurseries with a view to trying this crop. The extent of the local interest in tea in Selangor is indicated by the fact that there were 104 exhibits shown at the Exhibition, many of which were of quite fair quality.

Pineapples.—The main fruit season was terminating at the end of the month and supplies of fruit were in consequence much reduced.

One factory in Selangor was closed in the middle of the month and all available fruits were taken to the other factory.

A further area of 600 acres of pineapples was being planted in Kuala Langat District of Selangor. This area includes 100 acres of rubber trees 2½ years old which are being removed.

Pigs.—The demand for pure breed pigs from Serdang for crossing with the native breed continued in Selangor. One Middle White pair and one Large Black boar were ordered by Chinese market gardeners for use in new localities.

The Pig Section at the Exhibition provided a useful demonstration of the superior value of the cross bred animals and the twenty-seven entries of such pigs showed the extent to which the Chinese market gardeners in Selangor already realise the advantage of crossing with pure bred stock.

Agricultural Stations and Padi Test Plots.

Bukit Merah Padi Test Station.—Of the vegetables grown as an inter-season crop on the $\frac{3}{4}$ acre plot at this Station long beans gave a good crop and were practically over at the end of the month; ladies fingers, soya beans and ground nuts continued to do well, but brinjals and chillies made little growth. It is possible that these plants may have to be removed before they can be harvested to make way for the main crop of padi, the season for which is commencing earlier than usual.

Bukit Mertajam Agricultural Station.—The work of felling and clearing this 10 acre site was commenced at the beginning of the month and made good progress. Fencing posts were in course of erection.

Perak North Padi Test Plots.—Work was commenced on the establishment of three new padi test plots in the mukims of Briah, Kuala Kurau and Selinsing in Krian District and on another at Jebong in the District of Larut and Matang.

Selangor: Panchang Pedena Padi Test Station.—A site comprising 6 acres was selected for this Station in the centre of the new padi area. The jungle was felled in preparation for burning during the coming month.

Work on other Stations and Plots proceeded normally, though some of the Agricultural Stations suffered from drought. Good stocks of fruit seedlings for sale at low prices are being accumulated at several of these Stations.

Agricultural Show, Temerloh.

A well attended Agricultural Show was held at Temerloh on the 23rd July. Padi exhibits were numerous and of good quality but fruit exhibits were poor, as the season for most fruits was over. The Department of Agriculture provided an instructional exhibit of pure strain padis and of types of locally grown and cured tobacco leaf.

Rural Lecture Caravan.

The caravan visited parts of Province Wellesley, eleven centres in Perak North and seven centres in the coastal Districts of Selangor during the month. Lectures and film displays were well attended, interest being evinced more especially in the exhibits of pure strains of padi and in the demonstrations and lectures on improved methods of copra production.

Home Gardens.

As an outcome of the teaching given in School Gardens, school children in increasing numbers are making home gardens on their parents' land to provide vegetables for the household. This development is making marked progress in several parts of the country, especially where aided by Home Gardens Competitions. A successful competition of this nature was completed in the Kalumpang Mukim of Ulu Selangor District. Prizes were presented by the local headman and other local Malays and were awarded to the best kept home gardens in the Mukim. The gardens were judged by the Malay Agricultural Assistant.

DEPARTMENTAL NOTES.

Visit of H. E. The Governor to Serdang.

His Excellency, Sir Cecil Clementi, K.C.M.G., Governor and Commander-in-Chief of the Straits Settlements and High Commissioner of the Malay States visited the Government Experimental Plantation, Serdang, Selangor, and the School of Agriculture, Malaya, at Serdang on Thursday 14th July 1932.

Demonstrations to Chinese.

Demonstrations to Chinese were held at the Government Experimental Plantation, Serdang, on July 17th and 24th. The first of these demonstrations was to a party from Kuala Lumpur and the second to representatives from the Hua Chiao Public School, Tapah, Perak.

Appointment.

Mr. M. H. Blacker, M.C.S., has been appointed Personal Assistant to the Director of Agriculture, S.S. and F.M.S., and assumed duty on 18th July 1932.

Staff Changes.

H.H. Tunku Yaacob bin Sultan Abdul Hamid, B.A. (Cantab) to act as Principal Agricultural Officer, Kedah, with effect from 9th July, 1932.

Mr. N. H. Sands, Dip. Agr. (Wye) to be an Agricultural Officer (Temporary) in the service of the Kedah Government, with effect from 9th July, 1932.

Leave.

Captain J. M. Howlett, M.C., Agricultural Field Officer, has been granted 1 month and 26 days leave on full pay with effect from 5th July 1932, prior to retirement from the service.

Dr. H. W. Jack, Economic Botanist, has been granted 6 months and 28 days leave on full pay with effect from 9th July, 1932.

Mr. W. N. Sands, Principal Agricultural Officer, Kedah, has been granted 12 days leave on full pay prior to retirement with effect from 9th July 1932.

Mr. R. G. Heath, Agricultural Field Officer, returned from leave of absence on July 21st 1932. He has assumed duty as Agricultural Field Officer, Krian, Perak.

Statistical. MARKET PRICES.

July, 1932.

Rubber.—The average July spot price of rubber smoked sheet equal to London Standard was 5.39 cents per lb. in Singapore, 2.30 cents gold New York and 1.77 pence London as compared with 4.95 cents Straits, 2.64 cents (gold) New York and 1.81 pence in June.

Palm Oil.—Weekly quotations cabled during the month for oil palm c.i.f. Liverpool on a basis of 18 per cent. f.f.a. were £15.10.0 per ton on a steady market.

Copra.—The market continued steady throughout the month. Supplies have come forward freely. In Singapore, the average price of Sundried was \$5.40 and Mixed \$4.96 per picul compared with \$5.17 and \$4.72 respectively for June.

Copra cake advanced from \$1.75 to \$2 per picul at the end of the month, the average price for July being \$1.81 per picul.

Coffee.—Palembang coffee averaged \$16.15 per picul in Singapore as compared with \$16.87 per picul in June. Average Singapore quotations for Sourabaya coffee in July were \$21.06 to \$23.05 per picul, the price within this range depending upon quality.

Arccanuts.—Palembangs averaged \$3.20 per picul in Singapore as compared with \$2.77 in June, while Bila Whole averaged \$3.35 per picul as compared with \$2.90 in the previous month. Average prices in July for other grades were:—Split \$5.25 to \$6.95; Red Whole \$6.80 to \$8.25; Sliced \$9.45 to \$11.80; Kelantan Split \$6.75 to \$7.03 per picul, the price within each range depending upon quality.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during June 1932:—Siam No. 2 Ordinary \$3.89, Rangoon No. 1 \$3.88 as compared with \$3.77 and \$3.86 respectively in May.

The average retail market prices in cents per gantang of No. 2 Siam rice in June were:—Singapore 29, Penang 36, Malacca 27, corresponding prices in May being 29, 37 and 29.

Gambier.—Cube No. 1 has been quoted throughout the month at \$12.50 per picul as compared with an average Singapore price in June of \$14.70. Block gambier dropped from \$6.50 to \$6.25, the average price for the month being \$6.31 as compared with \$7.70 in June.

Pineapples.—The market closes dull. Average prices per case in Singapore during July were:—1½ lb. cubes \$3.07, 1½ lb. sliced flat \$3.32, 1½ lb. sliced tall \$3.06. Corresponding prices in June were \$3.27, \$3.15 and \$3.32.

Tapioca.—Prices have remained fairly steady. Average Singapore quotations per picul in July were:—Flake fair \$3.20; Pearl, seed \$3.85; Pearl, medium \$4; as compared with \$3.37, \$3.80 and \$4.20 respectively in June.

Sago.—Arrivals have met with a ready demand, prices shewing some advance during the month. Average Singapore prices per picul in July were :—Pearl, small fair \$4.25, Flour, Sarawak fair \$1.97 as compared with \$4.30 and \$1.93 respectively in June.

Mace and Nutmegs.—Demand has been very poor. Average prices of mace in Singapore during July were :—Siouw \$53.25, Amboina \$34.75 as compared with \$52.60 and \$37.40 per picul in June.

Nutmegs 110 per lb. averaged \$23.50 per picul in July as in June, while 80 per lb. averaged \$31.25 per picul as compared with \$27.90 per picul in June.

Pepper.—Prices have improved slightly over those recorded in June, the market being active at the beginning of July. Average Singapore prices per picul in July were :—Singapore Black \$18.44, Singapore White, \$24.31, Muntok White \$24.87 as compared with \$18.20, \$22.70 and \$23.50 respectively in June.

Cloves.—Nominal prices have been quoted in Singapore throughout July at Zanzibar \$43 per picul and Amboina \$45 per picul as compared with \$44 and \$47 respectively in June.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Weekly Reports published in July. Palm oil reports are kindly supplied by Messrs. Cumberbatch and Co, Ltd., Kuala Lumpur, and reports on the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57 Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

June, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during June, 1932, amounted to 46,668 tons as compared with 54,207 tons in June, 1931, of which 53.8 per cent. were consigned to Singapore, 17.8 per cent. to Penang, 8.8 per cent. to Malacca, 14.8 per cent. to the Federated Malay States, and 4.8 per cent. to the Unfederated Malay States.

Of these imports 65.0 per cent. were from Siam, 33.7 per cent. from Burma, 0.5 per cent. from French Indo-China and 0.8 per cent. from Other Countries.

Total foreign exports of rice in June, 1932, were 12,393 tons (including 231 tons domestic production, exported from Penang) as compared with 13,433 tons in June, 1931. Of these exports 86 per cent. went to Netherlands India and 14 per cent. to Other Countries.

Net imports for the period January to June, 1932, were 199,482 tons as compared with 262,210 tons for the same period of 1931, a fall of 23.9 per cent.

Reports from the padi growing districts in Malaya indicate that harvesting has been completed in Perak and Kedah, where crops are reported to be good on the whole. In Selangor and Negri Sembilan transplanting has commenced, while in Malacca, Province Wellesley and Perlis ploughing and preparation of the nurseries is in hand. Ploughing has been held up in several places on account of the prolonged drought.

India.—Total foreign exports of Rice (*Indian Trade Journal* 30.6.32) during April, 1932, were 231,000 tons as compared with 357,000 tons in March, 1932, and 246,000 tons in April, 1931, decreases of 35.3 per cent. in respect of the previous month and 6.1 per cent. in respect of the same period of the previous year.

Total exports of rice and bran from Burma for the period January 1 to May, 28, 1932, amounted to 1,702,282 tons as compared with 1,803,833 tons for the corresponding period of 1931 or a decrease of 5.6 per cent. Of these exports 424,331 tons went to India in 1932 as compared with 757,638 tons in 1931, a decrease of 44 per cent.

Japan.—According to the *Trans-Pacific* of June 9, 1932, the rice supply and demand for the period November, 1931, to the end of April, 1932, are as follows :—

Supply	Tons
Stocks on November 1, 1931	1,282,000
Production	7,744,000
Imports	65,000
Korean Imports	619,000
Formosan Imports	193,000
	9,903,000

*Abridged from the Rice Summary for June 1932, compiled by the Department of Statistics, S.S. and F.M.S.

<i>Demand</i>					
Exports ...	...	...	...	...	29,000
Consumption	...	...	...	...	5,263,000
					<hr/>
					5,292,000
Balance of Stocks on May 1, 1932	...	...	...	...	4,611,000

Siam.—Exports of rice from Bangkok during May, 1932, amounted to 128,215 tons as compared with 118,006 tons in May, 1931, or an increase of 8.6 per cent.

Exports of rice from Bangkok during the period December, 1931 to May, 1932, amounted to 740,199 tons, an increase of 98,699 tons or 15.4 per cent. as compared with the same period of 1930—31.

Netherlands India. Java and Madura.—The *Korte Berichten* states that at the end of May, 1932, the area harvested amounted to 4,961,250 acres, an increase of 213,500 acres or 4.5 per cent. as compared with the same period of 1931, the area damaged to 167,274 acres a decrease of 50,573 acres or 23.2 per cent. as compared with 1931, and additional plantings awaiting harvest to 3,563,000 acres an increase of 12,250 acres as compared with 1931, a total of 8,691,524 acres as compared with 8,516,347 acres for the same period of 1931, an increase of 2.1 per cent.

Imports of rice into Java and Madura during January to May, 1932, totalled 92,484 tons as compared with 144,374 tons for the same period of 1931 or a fall of 35.9 per cent.

Imports of rice into Outer Provinces during January to April, 1932, totalled 84,532 tons as compared with 113,898 tons for the same period of 1931 or a fall of 25.8 per cent.

French Indo-China.—Entries of padi at the port of Cholon from 1.1.32 to 30.6.32 amounted to 640,422 (metric) tons, an increase of 53,200 tons or 9.1 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period 1.1.32 to 30.6.32 amounted to 635,886 (metric) tons an increase of 109,437 tons or 20.8 per cent. as compared with the same period of 1931.

Stocks of padi in Cholon were considerably reduced by rice shipments to Japan. The rice market has been calm. Eastern markets generally have evinced little interest in Saigon rice.

Ceylon.—Imports for 5 months ending May 31, 1932, were 191,622 tons, an increase of 12,294 tons or 6.8 per cent. as compared with 1931.

Of these imports, 19.2 per cent. were from British India, 67.8 per cent. from Burma, .4 per cent. from the Straits Settlements and 12.6 per cent. from Other Countries (Cochin China, Siam, etc.).

Europe and America.—Quantities of ~~rice~~ shipped from the East were :—

- (a) The Europe, period January 1 to June 16, 1932, 520,025 tons as compared with 566,742 tons for the same period of 1931, a decrease of 8.1 per cent.

Of the 1932 shipments 63.0 per cent. was from Burma, nil from Japan, 29.9 per cent. from Saigon, 2.6 per cent. from Siam and 4.5 per cent. from Bengal, as compared with 70.8 per cent. from Burma, 2.4 per cent. from Japan, 16.2 per cent. from Saigon, 6.7 per cent. from Siam and 3.9 per cent. from Bengal in 1931.

- (b) To the Levant, period January 1 to May 14, 1932, 33,696 tons, an increase of 17,556 tons or 108.8 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to May 14, 1932, 60,993 tons, a decrease of 29,059 tons or 32.3 per cent. as compared with the same period of 1931.

MALAYAN AGRICULTURAL EXPORTS, APRIL AND MAY, 1932.

	Net Exports in Tons.						
	Year 1931	Jan. to May 1931	Jan. to May 1932	April 1931	May 1931	April 1932	May 1932
Arecanuts	19,266	8,085	10,620	1,024	1,539	1,990	1,522
Coconuts, fresh ...	10,468	3,058	54,209*	735	638	10,191*	21,041*
Coconut oil ...	9,909	4,106	4,262	888	867	857	763
Copra ...	100,809	34,127	28,568	7,797	6,355	5,383	4,542
Gambier, all kinds ...	2,563	1,030	1,278	232	203	187	262
Palm-kernels	726	266	486	64	85	35	186
Palm oil ...	4,574	1,464	2,751	398	263	485	824
Pineapples, canned ...	59,457	27,166	31,065	4,460	9,629	6,169	8,522
Sago,— flour ...	5,608	1,175	4,116	1,007	310†	691	337†
Sago,— pearl ...	2,429	754	1,126	180	234	211	273
Sago,— raw ...	2,904†	1,221†	1,461†	321†	174†	224†	188†
Tapioca,— flake ...	9,742	4,001	3,926	515	661	914	834
Tapioca,— flour ...	491†	109	76†	38†	41†	13†	32
Tapioca,— pearl ...	19,006	7,378	8,484	1,578	1,748	1,913	1,899
Tuba root	74	25	49†	3	7	11†	8

* '000 in number.

† net imports.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS.
FIRST HALF YEAR, 1932.

(As declared by Estates)

Month 1932	Palm Oil		Palm Kernels.	
	F. M. S.	Johore	F. M. S.	Johore
	Tons	Tons	Tons	Tons
January ...	359.4	55.7	63.9	7.7
February ...	433.8	47.1	73.2	7.0
March ...	651.2	121.9	103.5	15.2
April ...	632.3	84.8	98.0	11.7
May ...	458.7	80.6	83.9	7.6
June ...	495.5	126.2	84.6	14.7
Total first half year 1932 ...	3,030.9	516.3	507.1	63.9

The corresponding figures for the first half year 1931 were:—

F.M.S. Palm oil 1,744.2 tons Palm kernels 356.4 tons.

Johore Palm oil 267.8 tons Palm kernels 43.3 tons.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100 ACRES AND OVER, MALAYA, AT END OF JUNE, 1932.

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FEDERATED MALAY STATES :—							
Perak	238,420	16,192	6.8	31,465	13.2	47,657	20.0
Selangor	294,030	22,827	7.8	34,656	11.8	57,483	19.6
Negri Sembilan	217,002	20,190	9.3	24,111	11.1	44,301	20.4
Pahang	35,122	7,378	21.0	4,800	13.7	12,178	34.7
Total F.M.S. ...	784,574	66,587	8.5	95,032	12.1	161,619	20.6
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	3,957	9.0	8,090	18.4	12,047	27.3
Dindings	6,700	634	9.5	1,001	14.9	1,635	24.4
Malacca	110,288	6,383	5.8	20,852	18.9	27,235	24.7
Penang Island	1,585	1,058	66.8	94	5.9	1,152	72.7
Singapore Island	28,033	14,179	50.6	4,217	15.0	18,396	65.6
Total S.S. ...	190,661	26,211	13.7	34,254	18.0	60,465	31.7
UNFEDERATED MALAY STATES :—							
Johore	313,385	44,408	14.1	35,341	11.3	79,749	25.4
Kedah (a)	102,220	5,209	5.1	9,161	9.0	14,370	14.1
Kelantan	16,785	6,184	36.8	1,590	9.5	7,774	46.3
Trengganu (b)	4,300	nil	nil	nil	nil	nil	nil
Perlis	624	308	49.4	156	25.0	464	74.4
Total U.M.S. ...	437,314	56,109	12.8	46,248	10.6	102,357	23.4
Total MALAYA ...	1,412,549	148,907	10.5	175,534	12.4	324,441	23.0

MALAYA RUBBER STATISTICS **STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER INCLUDING LATEX, CONCENTRATED LATEX AND REVERTED.** **FOR THE MONTH OF JUNE, 1932 IN DRY TONS.**

Territory	Stocks at beginning of month 1				Production by estates of 100 acres and over				Imports				Exports				Stocks at end of month	
	Dealers		Ports		during the month		during the year 1932		during the year 1932		during the year 1932		during the month		during the year 1932		Ports	Dealers
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
MALAY STATES:—																		
Federated Malay States	...	17,010	13,501	11,528	70,460	5,424	43,612	NH	NH	NH	NH	13,459	4,998	80,756	34,369	...	15,709	13,354
Jobore	...	2,599	3,201	3,551	21,735	3,043	19,977	NH	5	NH	29	1,032	5,201	5,694	35,970	...	2,689	3,984
Kedah	...	649	2,086	2,174	13,436	778	4,958	NH	NH	NH	NH	659	2,571	3,795	14,649	...	604	1,953
Perlis	...	32	13	6	38	1	44	NH	NH	NH	NH	NH	5	NH	68	...	35	12
Kelantan	...	73	170	153	798	5	1,217	32	NH	179	NH	10	243	223	2,003	...	48	133
Trengganu	...	55	50	100	588	51	296	NH	5	NH	NH	NH	161	NH	883	...	55	50
Total Malay States	...	20,318	19,020	17,511	107,052	9,302	70,103	32	5	179	29	15,170	13,087	90,438	87,942	...	19,131	18,785
SETTLEMENTS																		
Malacca	...	3,311	1,405	1,297	7,973	(2)	(2)	NH	NH	NH	NH	3,608	3,886	23,080	NH	...	3,410	1,385
Province Wellesley	...	136	574	478	2,537	1,886	11,154	NH	13,067	2,788	88,039	3,886	NH	31,601	NH	...	97	526
Dindings	...	318	101	87	571	14	14	200	4,308	29,728	88,039	13,902	NH	147,644	NH	1,446	287	94
Penang	...	463	3,597	226	145	917	917	4,308	13,087	23,516	88,039	21,396	NH	147,644	NH	3,694	3,480	12
Singapore	...	4,511	34,679	226	145	917	917	4,308	13,087	23,516	88,039	21,396	NH	147,644	NH	3,694	3,480	12
Total Straits Settlements	...	4,974	42,041	3,319	2,008	12,012	12,012	1,880	11,154	4,508	13,087	21,396	NH	147,644	NH	5,340	23,331	2,268
TOTAL MALAYA	...	4,974	62,359	21,339	109,064	11,182	81,257	4,540	13,092	23,695	88,068	36,566	13,087	23,695	87,942	5,340	43,462	21,053

TABLE II
DEALERS' STOCKS IN DRY TONS

DEALERS' STOCKS IN 1921						
Class of Rubber	Federated Malay States	Singapore	Penang	Province Wellesley	Jobore	Total
20	21	22	23	M. Cca.	24	25
DRY RUBBER	18,172	15,528	3,041	3,635	1,264	34,640
WET RUBBER	2,537	2,518	439	175	1,418	7,082
TOTAL	15,709	16,041	3,480	3,810	2,682	41,722

TABLE III
FOREIGN EXPORTS

Ports	For month	For month
Singapore	22,895	145,358
Penang	7,486	54,650
Port Swettenham	5,785	33,359
Malacca	530	4,785
MALAYA	36,566	238,082

TABLE IV
DOMESTIC EXPORTS

Area	For month	For month
Malay States	...	32,017
Straits Settlements	...	20,427
MALAYA	...	52,017

- Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. i. e. Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] + [21] + [22] + [23] + [24] + [25] + [26] + [27] + [28] + [29] + [30] + [31] + [32] + [33] + [34] + [35] + [36] + [37] + [38] + [39] + [40] + [41] + [42] + [43] + [44] + [45] + [46] + [47] + [48] + [49] + [50] + [51] + [52] + [53] + [54] + [55] + [56] + [57] + [58] + [59] + [60] + [61] + [62] + [63] + [64] + [65] + [66] + [67] + [68] + [69] + [70] + [71] + [72] + [73] + [74] + [75] + [76] + [77] + [78] + [79] + [80] + [81] + [82] + [83] + [84] + [85] + [86] + [87] + [88] + [89] + [90] + [91] + [92] + [93] + [94] + [95] + [96] + [97] + [98] + [99] + [100]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced to dry weights.
3. Dealers' stocks on estates of less than 100 acres are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%.
4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States, being domestic production.
5. The above, with certain omissions, is the Report published by W. A. Boyd, M. C. Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 22nd July, 1932.
- Special Note.—The stocks as shown in the annexed returns in not due to heavy exports in June 1932; but to the discovery of cumulative errors extending over some years in the returns of stocks furnished by dealers. In fact for a considerable time past the stocks as reported in Form 1. & E. 6 have been largely in excess of the true stocks.

METEOROLOGICAL SUMMARY, MALAYA, JUNE, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL					BRIGHT SUNSHINE				
	Means of					PERATURE		Total	Most in a day	Number of days			Total	Daily Mean	Per cent		
	A.	B.	Min.	Max.	A and B	Absolute Extremes				Precipitation .01 in or more	Thunderstorm .05 in or more	Fog morning obs.				Gale force 8 or more	
						Lowest	Highest										Lowest	Highest	Min.	Max.
	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.			hr.	%			
Railway Hill, Kuala Lumpur, Selangor	91.6	73.1	82.3	95	70	83	75	2.13	54.1	1.44	8	6	2	1	198.85	6.63	54
Bukit Jeram, Selangor	89.7	73.6	81.7	94	70	80	76	4.34	110.3	3.59	8	6	1	3	226.20	7.54	61
Sitiawan, Perak	90.1	72.8	81.5	93	69	77	76	3.66	92.7	1.40	10	7	5		206.60	6.89	56
Kroh, Perak	85.9	69.5	77.7	89	67	82	73	6.01	152.7	1.39	19	15	1		191.45	6.38	51
Temerloh, Pahang	89.3	72.2	80.7	92	70	85	75	7.88	200.2	2.12	14	11	4	6	196.50	6.55	53
Kuala Lipis, Pahang	88.9	71.5	80.2	92	69	83	75	6.25	158.8	1.24	19	15	3	19	143.80	4.79	38
Kuala Pahang, Pahang	87.4	73.6	80.5	90	71	85	77	5.96	151.4	1.50	10	10	4	1	231.70	7.72	63
Mount Faber, Singapore	86.4	74.6	80.5	90	70	81	79	7.07	179.6	1.56	15	13		4	161.65	5.39	42
Butterworth, Province Wel-lesley	87.8	73.8	80.8	91	71	84	77	10.34	262.6	2.00	19	15		1	186.85	6.23	50
Bukit China, Malacca	85.3	73.6	79.5	88	71	81	77	6.80	172.7	1.26	16	13			206.45	6.88	56
Kluang, Johore	88.2	71.8	80.0	92	69	82	74	4.80	121.9	1.66	15	13	2	4	167.10	5.57	45
Bukit Lalang, Mersing, Johore	87.9	72.1	80.0	92	69	83	74	4.39	111.5	1.10	14	12	1		185.20	6.17	50
Alor Star, Kedah	87.7	74.4	81.1	91	72	84	78	8.49	215.7	1.79	23	20	5	1	202.40	6.75	54
Kota Bharu, Kelantan	90.5	73.3	81.9	93	72	86	75	5.85	148.6	1.06	20	15			231.00	7.70	62
Kuala Trengganu, Trengganu	88.3	72.1	80.2	92	70	83	75	7.62	193.6	3.19	16	13	4		228.20	7.61	61
HILL STATIONS.																	
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	72.2	59.4	65.8	76	56	67	61	5.12	130.1	1.29	17	13		1	164.75	5.49	44
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.2	58.5	65.9	77	53	67	63	5.88	149.4	1.80	21	15	2	2	150.40	5.01	41
Fraser's Hill, Pahang 4268 ft.	75.6	63.3	69.5	79	61	66	66	3.86	98.1	0.79	18	14	3	3	195.20	6.51	53

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE
Malayan Agricultural Journal.

SEPTEMBER, 1932.

EDITORIAL.

***Production of
Palm Oil.**

The production of palm oil under plantation conditions renders it possible to obtain a quality of oil unequalled by the product from the forests of West Africa. Under plantation conditions the fruit can be harvested in the correct condition of ripeness and can be transported to the nearby factory without the delay which results in a high percentage of acidity in the oil as marketed. Immediately on arrival at the factory, the fruit bunches are subject to treatment with live steam which inhibits the enzyme action that causes acidity of the oil.

The procedure from harvesting to sterilising has been considerably improved as a result of the experience gained on estates during the past few years.

Likewise, factory methods are constantly being studied by the Department of Agriculture as well as by producers. The results of these endeavours are to be seen in improved efficiency in the factory, as judged firstly, by the very small amount of unrecovered oil and by the excellent and uniform quality of the oil.

The experimental factory at the Government Experimental Plantation, Serdang, is now in a position to contribute results of material value to oil palm producers. In the article contributed to the present number by Major C. D. V. Georgi on "The Centrifugal Extraction of Palm Oil at Serdang" the author adumbrates the procedure which is adopted in that factory and produces evidence of a high efficiency of production by that method. While much of this procedure is well known to producers, we would invite attention in particular to certain methods of manipulation which have been found to produce greater efficiency. For instance, the addition of 15 per cent. of fresh trash to the fruit before digestion overcomes a tendency for the mash to become sticky, for the fibrous residue to clog the screen, and of the nuts to be oily.

Methods of testing the efficiency of the process are given some prominence and should prove of great assistance to producers.

It should be remembered that the present article deals with but one method of oil extraction, and it is not to be implied that the author or the Department recommends this particular type of machinery in preference to other makes or systems. Similar work with the press system will be carried out and the results are to be published in this Journal in due course.

Indian Market for Copra.

In the July number of this Journal we directed attention, by means of an Editorial and of an article on Coconuts and Copra in 1931, to the importance of India as a market for high quality copra. It was pointed out that India not only consumes the whole of her Malabar production, but in 1931 took an increasing quantity of Ceylon copra. This resulted in a sharp rise in price on the European market for Ceylon copra. We further suggested that if Ceylon copra is to be permanently diverted to India it behoves Malaya to export an improved product to the European markets to replace the Ceylon supplies.

The Ceylon papers recently to hand publish a memorandum by the Minister of Agriculture and Lands, Ceylon recommending a cess on copra for the purpose of a propaganda campaign to extend the market for Ceylon coconut products in India.

In the ordinary way we should not have referred to this matter, which is the concern of Ceylon alone. In view, however, of the fact that the Minister of Agriculture and Lands freely quotes in his memorandum, the editorial and article from this Journal, it is perhaps well that some explanation be given in this place of the attitude of this Department concerning copra research work carried out in Malaya.

It is possible that some may consider that the interests of Malaya are antagonistic to those of Ceylon; that we are, in fact, by our efforts to improve the quality of the Malayan product, attempting to capture the Ceylon market.

This of course is not the case. We realise that with an improved product we shall be able to command a better price for our copra owing to the increased value of the copra to the crushers. Our references to the increasing importance to Ceylon of her Indian market, however, cannot but be of interest to Malaya because it indicates that Europe will have to obtain from other sources the supplies of high grade copra to replace any shortage of supplies from Ceylon. We are ambitious enough to hope that Malaya may be able to satisfy this demand should it arise.

It is perhaps relevant again to remind our readers, that the copra research work in Malaya is partly paid for by the Empire Marketing Board and that the results of this work are, through our publications, available to producers the world over. A comparison of Ceylon and Malayan conditions of copra preparation are stated in detail in the Special Bulletin of this Department: "Investigations on Coconuts and Coconut Products" by Mr. F. C. Cooke, Assistant Chemist for Copra Investigations. The author visited Ceylon in this connection and obtained very great assistance in his investigations from both officials and planters in that Island.

The endeavours of Ceylon to widen the market for her copra is of importance to the Empire; similarly our attempt to improve the quality of Malayan copra has a value not confined to this country. Our aims are not antagonistic but are in fact complementary to those of Ceylon.

Original Articles.

THE CENTRIFUGAL EXTRACTION OF PALM OIL AT SERDANG

BY

C. D. V. GEORGI,

Acting Agricultural Chemist.

Introductory.

The present article summarises the results to-date of various experiments carried out regarding the factory treatment of oil palm fruit to which reference was made in a previous number of this Journal, Vol. XIX, No. 8, August 1931.

As will be seen from the proposed scheme of work outlined in that article each experiment had for its object the determination of the optimum conditions for a particular stage in order to secure the maximum efficiency for the whole process. It is proposed, therefore, first of all to record the results of the individual experiments and then to describe briefly the present process with special reference to its efficiency.

It is to be regretted that owing to a breakdown with the Stork press it has not yet been found possible to compare the efficiencies of the press and the centrifugal processes; the present paper deals, therefore, only with the centrifugal process for the treatment of the fruit. The results of the comparative experiments with the press and the centrifugal extractor will be published in a further paper.

Sterilisation of Fruit.

The original procedure was to subject the fruit to the action of live steam for a period of one hour, but experiments have shown that this period can be reduced to 45 minutes without either affecting adversely the resultant acidity of the oil or necessitating an increase in the period of digestion. In this connection, it should be remembered that the preliminary sterilisation of the fruit serves a double purpose, the inhibition of enzyme action and the softening of the fruit, the latter being of importance as regards the subsequent digestion of the fruit and extraction of the oil.

The present procedure is, therefore, to sterilise the fruit for 45 minutes, live steam being admitted in quantity for approximately 10 minutes until the temperature of the fruit has been raised to approximately 100°C.; the supply of steam is then reduced until only a very small amount escapes through the lid of the steriliser, these conditions being maintained for the remainder of the period of treatment.

The object of the rapid heating of the fruit at the commencement of the operation is to inhibit as quickly as possible enzyme action developing as a result

of the inevitable further bruising associated with the handling of the cleaned fruit in the factory.

During the process of sterilisation a small amount of oil exudes from the fruit and escapes with the condensed steam. The mixed liquid from the sump below the sterilisers is therefore collected and transferred to the sludge treatment tank in order to recover the oil.

Digestion of Fruit.

Since there is no doubt that, as far as the recovery of oil is concerned, the digestion of the fruit is the most important part of the centrifugal process, particular attention was paid to a study of the conditions necessary to ensure the best results. In this connection it may be mentioned that with the Manlove Alliott closed type digester there are three variables (*a*) the period of digestion (*b*) the steam pressure in the jacket of the digester (*c*) the steam pressure in the body of the digester; so that it was arranged to study each variable separately, the other two being maintained constant during the experiments.

Further, as a measure of comparison of results it was decided to utilise the figure for the oil content of the pericarp residue, calculated on a moisture-free basis, remaining after centrifugal extraction under controlled conditions.

Period of Digestion: The original procedure was to digest the sterilised fruit for 25 minutes, maintaining excess steam pressures of 45 lbs. per square inch in the jacket of the digester and 5 lbs. per square inch in the body.

A series of observations in which these pressures were maintained constant but the period of digestion was varied showed that a period of 25 minutes, especially with fully-developed ripe fruit, was barely sufficient to effect complete disintegration, better results being obtained by extending the period to 30 minutes. It was found that if digestion was only carried out for 25 minutes there was frequently a small proportion of undigested fruit, the presence of the latter becoming still more marked if the period was reduced to 20 minutes.

These observations were confirmed by the results of analysis of average samples of the pericarp residue from the centrifugal extractor as the following figures for the oil contents, calculated on a moisture-free basis, show:—

Period of digestion	Oil content of residue
minutes.	(Moisture-free basis)
	per cent.
20	29.6
25	28.1
30	25.5

Further, another series of experiments showed that there was no advantage to be gained by prolonging the period of digestion to 35 or 40 minutes, in fact the results of analysis of samples of pericarp residue from fruit digested for these periods showed that there was a tendency for the oil content of the residue to increase compared with that for fruit digested for 30 minutes. It appears as if as a result of the prolonged period of digestion the mash is apt to become

thick and gummy and to retain a slightly increased amount of oil as the following figures show :—

Period of digestion	Oil content of residue (Moisture-free basis)
minutes.	per cent.
25	25.9
30	22.7
35	24.8
40	25.1

With regard to the discrepancies between the figures for the oil contents of the pericarp residue from fruit digested for the same period on different occasions it is considered that these are due to variations in the oil content of the mixed fruit, a considerable proportion of the fruit then harvested being obtained from comparatively young palms. In spite of the discrepancies it is considered that the results for the two series of experiments are sufficiently accurate to enable the above conclusions to be drawn.

Steam Pressure in Jacket: As regards the excess steam pressure in the jacket of the digester, a further series of experiments in which the fruit was digested for 30 minutes and the excess steam pressure in the body of the digester maintained at 5 lbs. per square inch showed that an excess steam pressure of 45 lbs. per square inch in the jacket was unnecessary. With such a pressure the mash, especially with fully ripe fruit, is apt to thicken and to retain an increased amount of oil. A high steam pressure in the jacket has the same effect therefore as a prolongation of the period of digestion.

It was found that better results were obtained with an excess steam-pressure in the jacket of only 15/20 or even 5/10 lbs. per square inch, that is, merely enough steam to maintain the lining of the digester at a temperature slightly greater than 100°C.

The following figures for the oil contents of samples of the pericarp residue, calculated on a moisture-free basis, show the extent of the variations.

Steam pressure in jacket	Oil content of residue (Moisture-free basis)
lbs per square inch.	per cent.
45/50	28.5
35/40	27.1
25/30	26.0
15/20	24.8
5/10	25.4

As mentioned previously, fully ripe fruit was used for the experiments, which were carried out during the months of August/September when it would appear that the oil content of the fruit shows a slight seasonal increase corresponding with the maximum harvest. This would account for the slightly higher figures for oil content of residue recorded in the table compared with others previously given for fruit treated under the same conditions.

Steam Pressure in Body: The results of experiments in which the fruit was digested for 30 minutes and the excess steam pressure in the jacket kept constant at 5/10 lbs. per square inch, only the steam pressure in the body being varied, showed that an excess steam pressure of only 5 lbs. per square inch in the body was required. If a higher body steam pressure was maintained or the fruit was digested without steam the mash tended to become thick and gummy and to retain oil, as indicated by a slight increase in the oil content of the pericarp residue.

The figures in the following table show the extent of the variations, consequent upon the changes in steam pressure in the body of the digester.

Pressure in body of digester	Oil content of residue (Moisture-free basis)
lbs. per square inch.	per cent.
Nil.	29.5
5	24.3
10	27.6

As a result of the whole investigation it was decided therefore to digest the sterilised fruit for 30 minutes, excess steam pressures of 5/10 lbs. per square inch and 5 lbs. per square inch being maintained in the jacket and the body of the digester respectively.

Centrifugal Extraction of Oil.

Provided the digestion of the fruit has been satisfactory, the centrifugal extraction of the oil calls for little comment, except that it is essential to ensure that the normal speed of the extractor, 900 revolutions per minute, is maintained.

The mash from the digester is treated for a period of 15 minutes in the extractor. No steam is admitted during the first three minutes of the process, the object being to expel the greater part of the oil, which flows readily as soon as the extractor commences to increase in speed. Steam at a pressure of 35—40 lbs. per square inch, as indicated by a pressure gauge fixed in the supply steam-pipe, is injected into the mass for 9 minutes, after which it is turned off, the basket being then spun for the remaining three minutes of the process. The object of running without steam for the last three minutes is to expel excess water and reduce the moisture content of the mass prior to the separation of nuts and fibrous residue in the depericarper screen.

A suggestion was made that the oil content of the pericarp residue from the centrifugal extractor might be reduced and an additional quantity of oil recovered by breaking down the residue in the basket, trimming the load and spinning for a further period of 10 minutes with the addition of more steam.

The results of experiments showed, however, that only a very small amount of additional oil could be recovered, the oil content of the residue, calculated on a moisture-free basis, being reduced on the average from 24 to 23 per cent. This reduction corresponds to an additional recovery of possibly 0.25 per cent of oil, mostly in the form of sludge, so that the secondary treatment of the residue by this method would not appear to be economical.

Further, from the point of view of the upkeep of the centrifugal extractor, such a procedure is also not to be recommended on account of the tendency of the basket to deviate from an even running spinning motion consequent upon the difficulty of trimming the caked residue.

Washing of Crude Oil.

No difficulty has been experienced as regards the separation of the oil from the mixture of oil and water obtained in the centrifugal process.

The mixed liquid in the washing tank is boiled for 2 hours with live steam and allowed to settle for 16 hours. The oil and water will then be found to have separated almost completely with only a small amount of sludge between the two layers.

In view of the relatively large amount of cellular matter this is somewhat surprising, especially as the volume of the oil is rather greater than twice that of the water and no water, other than the small amount of steam which condenses during the boiling, is added.

The oil content of the wash water varies from 0.05 to 0.10 lbs. per gallon so that, apart from the sludge that is subjected to a secondary treatment, the loss of oil in the water run off from a tank containing say 160 gallons (1440 lbs.) of oil is only approximately 6 lbs.

Experiments show that the total solids in the water from the washing tanks amount to approximately 10 per cent. These solids consist principally of organic matter; for example, gummy substances and fruit juices leached out during the process of extraction.

As regards the mineral constituents analyses show that the phosphoric acid content, calculated as P_2O_5 , amounts to approximately 0.08 lbs. per gallon while the potash content, calculated as K_2O , may be as much as 0.23 lbs. per gallon. Although these figures indicate that the liquid is comparatively rich in these plant constituents, the extent of their availability is doubtful in view of the large proportion of mucilaginous matter present.

Treatment of Sludge.

After as much clean oil as possible has been drawn off through the main oil-cock the remaining liquid, usually referred to as sludge, is run off from the bottom of the tank for further treatment as regards recovery of oil. For a full charge the volume of sludge amounts to approximately 20 gallons, this figure representing the volume of the tank space below the level of the main oil-cock.

The sludge is passed through a coarse sieve to remove any small nuts and fibrous residue that may have passed over with the crude oil from the centrifugal extractor and diluted with an approximately equivalent volume of water.

The mixed liquid is boiled with live steam for two hours in an open tank and allowed to settle for 16 hours, the treatment being similar to that employed for the crude oil.

A satisfactory separation is obtained with practically no sludge between the oil and water layers. As will be realised, however, on account of the diameter of the tank it is not convenient to effect a complete separation of oil and water, so that when as much oil as possible has been drawn off the balance of the liquid is retained in the tank and mixed with the next charge of sludge.

Purification of Oil.

The oil from the washing tanks and the sludge treatment tank is passed through a fine mesh metal gauze filter to remove the small amount of fibrous matter in suspension in the oil and is then collected in a cylindrical tank situated below ground level. This tank can be closed and steam admitted by means of a valve; this has the effect of forcing the oil from the tank along the pipe to the supply tank for the De Laval separator. Filtration of the oil is advisable on account of the liability of fibrous matter to collect in some part of the piping leading to the separator, thereby causing a stoppage.

Formerly, the oil before reaching the separator was washed again by upward passage through a tank filled with hot water. Experiments showed this additional washing to be unnecessary, at any rate with oil prepared by the centrifugal process, washed and settled in the manner described. The present procedure is therefore to heat the oil in the supply tank by means of closed steam coils to a temperature of approximately 75—80°C and deliver direct to the De Laval separator.

As regards the separator, it has been found by experiment that the best results are obtained with a gravity disc 089—092, 53 mm.

Provided the speed of the separator is maintained according to that specified by the makers, no difficulty has been found in removing practically the whole of the matter in suspension and maintaining the moisture content below 0.25 per cent. as the figures for the analyses of average samples of the oil for the past six months show:—

Month.		Moisture per cent.	Matter in suspension per cent.
January	...	0.24	Trace
February	...	0.25	Trace
March	...	0.23	Trace
April	...	0.24	Trace
May	...	0.22	Trace
June	...	0.20	0.01

Although the separator is said to have a purifying capacity of 110 gallons per hour, experience shows that to maintain the above high standard of quality of oil over a day's run the machine should only work at approximately half this capacity, that is, a barrel, 40 gallons, filled in approximately 40 to 45 minutes.

The small amount of oil-water emulsion discharged from the separator is returned to the sludge tank for treatment, thereby retaining as much as possible of the oil in the system.

Analyses of the black sludge deposited inside the bowl of the separator have shown the material to have the following composition :—

	per cent.
Moisture	... 73.9
Oil	... 12.3
Residue (by difference)	... 13.8
	100.0
Oil (on dry basis)	... 47.1

Although the oil content of the residue, calculated on a moisture-free basis, is relatively high, the amount of residue is small. Records show that the total loss of oil in the separator when purifying say 1 ton of oil is approximately $\frac{3}{4}$ lb. No attempt is made to recover this oil on account of the matter in suspension associated with it, especially as the former is in a very fine state of division.

Separation of Pericarp Residue and Nuts.

The separation of the pericarp residue from the nuts is effected by agitating the mass discharged from the centrifugal extractor in a revolving screen, usually referred to as a depericarper screen.

The screen is mounted with one end slightly higher than the other so that by feeding the material at the upper end, the nuts gradually travel along the screen to the lower end where they are discharged, the fibrous residue passing between the iron rods of which the sides of the screen are composed.

The screen, which is rectangular in shape, the sides being approximately 3 feet wide, is 16 feet long and divided into three sections, in each of which a different arrangement of rods has been made. The rods in each section are fitted into frames, which are interchangeable.

In the first section circular rods are fitted vertically to the axis of the screen, in the second the rods are similarly fitted but in this case they are rectangular and arranged diagonally in the frame, while in the third section the rods are circular and fitted horizontally to the axis of the screen.

No difficulty has been experienced as regards effecting a satisfactory separation of the fibrous residue and nuts, even though the residue contains approximately 50 per cent. of moisture. It is estimated that approximately 80 per cent. of the fibrous residue separates in the first section of the screen.

A certain amount of trouble was caused owing to a proportion of the small nuts being discharged with the fibrous residue. This was due to the rods ($\frac{3}{8}$ inch) being insufficiently strong to withstand the impact of the nuts, some of which would become firmly wedged, thereby causing the rods to bend slightly and permit smaller nuts to find their way between the rods. This was remedied by inserting cross bars where necessary so as to reduce the free length of the rods.

Further, it was noticed that when working with well developed fully ripe fruit, there was a tendency for the spaces between the rods to become choked,

thereby necessitating frequent cleaning. This is doubtless due to the stickiness of the residue consequent upon the presence of gummy substances in the fruit. The effect became, however, much less marked if the fruit was mixed with a small proportion of trash before treatment, the nuts discharged from the lower end of the screen being also less oily. The question of the addition of trash to the fruit before treatment will be referred to later.

Since there is no secondary treatment of the pericarp residue, the material from the screen is spread out to dry on the floor of the factory before being used as fuel for the boiler.

Drying and Cracking of Nuts.

The method adopted for drying the nuts follows that described in the *Malayan Agricultural Journal* for October, 1929. The clean nuts discharged from the screen are stored in bins for 12 to 14 days in order to reduce the moisture content of the kernels so as to ensure satisfactory cracking of the nuts that is to prevent an undue proportion of damaged kernels.

Care is taken to keep each batch of nuts separate so as to maintain a regular period of storage, also after the period of storage to remove the wet nuts from the top of the pile and to crack only the dry ones. The wet nuts are incorporated into another pile of fresh nuts from the screen.

Although the nut cracker at present in use in the factory has only a small capacity, being an experimental machine purchased some years ago from Culley Expressors Ltd., satisfactory results have been obtained as regards the proportion of whole kernels after this period of storage for the nuts.

Manufacture of Kernels.

The kernels and shell fragments are separated by means of a suspension of clay in water in which, as is well-known, the kernels float while the shell fragments sink.

The kernels are washed to free them from adhering clay and dried in thin layers on the floor of the factory. The usual period of drying varies from 8 to 10 days.

The shell fragments are washed with water, allowed to dry and used as fuel for the boiler.

On account of the present relatively small output of kernels, approximately 1 ton per month, and the long period that must elapse before a sufficient quantity has accumulated to warrant shipment, all broken and damaged kernels are picked out before bagging. In this connection it may be mentioned that any kernels that float when the latter are washed with water are also rejected, since experience shows that such kernels are invariably unsound.

By storing only the whole kernels, the liability to deterioration during storage will be reduced to a minimum, since it is well known that damaged and broken kernels, in which the flesh is exposed to the air, are apt to become mouldy, the oil develops acidity and the quality of the whole consignment will suffer accordingly.

Summary of Process.

Having thus recorded briefly the results of the individual experiments relating to the various stages it seems advisable to summarise the conditions for the whole process. Before doing so, however, there are two points to which attention should be drawn (a) the addition of trash to the fruit before treatment (b) a slight modification in the pressure of digestion.

The original digestion experiments showed the importance of mixing the fruit before treatment, that is for each charge for the steriliser to consist as far as possible of a mixture of overripe fallen fruits, also outside and inside fruits stripped from the bunches. As explained previously, it was found, for example, that if fully developed ripe fruits were treated separately there was a tendency for the mash to become somewhat sticky and for the fibrous residue to clog the screen, while the surfaces of the nuts were apt to be oily.

Further, the oil content of the pericarp residue from such fruit, calculated on a moisture-free basis, might be as high as 32 per cent. compared with the average figure of 24 per cent.

Experiments showed that the recovery of oil from such fruits could be improved by the addition of a small amount of bunch trash before treatment. The addition of 15 per cent. by weight of fresh trash to such fruit before digestion brought about a reduction in the oil content of the residue, calculated on a moisture-free basis, from approximately 30 per cent. to 20 per cent. This is a greater decrease than that due to the addition of such a proportion of oil-free trash.

Further, the residue separates more easily in the depericarper screen, while the surfaces of the nuts are less oily.

As a result, therefore, it has been decided to leave a small proportion of trash with the fruit, the latter only being picked clean in the collecting sheds when such fruit is required for a particular experiment. In this connection it may be mentioned that the introduction of this modified method of separating the fruit from the bunches has resulted in a saving of the labour required in the collecting sheds.

As regards the variation in the pressure for digestion it was found that an excess steam pressure of 5/10 lbs. per square inch was hardly sufficient to heat the jacket of the digester rapidly enough at the commencement of the day's run to enable the optimum results to be obtained. Accordingly, the pressure in the jacket is now maintained at 15/20 lbs. until the first two charges have been digested, after which the pressure is reduced to 5/10 lbs. for the remainder of the day.

The whole process may therefore be summarised as follows:—

- | | |
|----------------------|---|
| <i>Fruit</i> | Loose fruit, well mixed, still containing a small proportion of bunch trash. |
| <i>Sterilisation</i> | 45 minutes with live steam. The hot fruit should be transferred as quickly as possible to the digester. |

<i>Digestion</i>	30 minutes, 5 lbs. pressure in body, 15/20 lbs. in jacket for first two charges, 5/10 lbs. for remainder of working day.
<i>Centrifugal extraction</i>	15 minutes, steam injected from 3 minutes after starting to 3 minutes before stopping.
<i>Washing of crude oil</i>	2 hours boiling with live steam, settling for 16 hours. The proportions of oil to wash water after sedimentation should be approximately 2 of oil to 1 of water.
<i>Treatment of sludge</i>	The sludge is diluted with approximately its own volume of water, the liquid is boiled with live steam for 2 hours after which it is settled for 16 hours.
<i>Purification of oil</i>	The washed oil and the oil recovered from the treatment of the sludge are passed through a fine metal gauze filter and run direct to the De Laval separator.
<i>Treatment of centrifuge residue</i>	The pericarp residue is separated from the nuts in a revolving screen. The pericarp residue is used as fuel.
<i>Treatment of nuts</i>	The nuts are dried and cracked. The kernels are recovered, the shell fragments being used as fuel.

Efficiency of Process.

One result of the installation of a depericarper screen has been the possibility of making determinations of the efficiency of the process as far as recovery of palm oil, the more important constituent of the fruit, is concerned.

The efficiency of the process represents the amount of oil recovered compared with the total amount of oil present in a given weight of fruit. Taking the total amount of oil in the fruit as 100 it is usual to express the efficiency as a percentage.

With the relatively large amounts of fruit involved in factory treatment it will be realised that the total amount of oil in a given weight of fruit cannot conveniently be directly determined and must be calculated. The figure is accordingly arrived at by adding to the weight of oil recovered the calculated amounts of oil lost at various stages of the process, the waste products themselves being either weighed or measured, then sampled and analysed for oil content.

Much depends therefore on the sampling methods adopted, since, however accurate the analysis, the results of the latter will be of little value if the sampling is also not relatively accurate.

Sampling of Waste Products.

When commencing the process with loose fruit, oil is lost as follows :—

- (a) Pericarp residue,
- (b) Surface of the nuts,
- (c) Washing of crude oil,
- (d) Purification of sludge.

It was necessary therefore to devise methods for sampling each of these waste products.

(a) *Pericarp residue.* The pericarp residue falling between the rods of the screen was continually collected and weighed in baskets. Each basket held approximately 45 lbs. From every alternate basket 250 grammes (approximately $\frac{1}{2}$ lb.) of the residue was weighed and placed in a tin provided with a cover, the sample for analysis being eventually drawn from the contents of the tin.

Care was taken to ensure that the pericarp residue was practically free from nuts, since it will be realised that the presence of a small proportion of nuts would vitiate the results, especially if a small nut was drawn in the sample for analysis.

Further, the pericarp residue was mixed before weighing into baskets, since experiments have shown a slight increase in the oil content of this residue according to the distance which it travels along the screen. Material discharged between the rods at the lower end has a slightly higher oil content than that which passes through almost immediately at the upper end.

(b) *Nuts.* The nuts discharged from the lower end of the screen were collected and weighed in baskets. Each basket held approximately 90 lbs. From every alternate basket 500 grammes (approximately 1 lb.) of the nuts was weighed and placed in another tin provided with a cover, the sample for analysis being eventually drawn from the contents of the tin.

(c) *Washing of crude oil.* After the height of the level of the oil had been measured and the water was being run off, a sample (approximately 250 c.c.) was taken with each three inch reduction in level. Sampling was continued until oil appeared at the test cock on the tank, when the height of the level of the oil was again noted.

The small samples were bulked in a bottle from which the sample for analysis was drawn.

The tank had previously been calibrated so that the volume in gallons corresponding to the reduction in level, that is the amount of wash water, could be calculated.

(d) *Purification of sludge.* A similar procedure was adopted with the purification of the sludge, except that, owing to the smaller volume of liquid, a sample was taken with each two inch reduction of level.

Analysis of Waste Products.

The following procedure was adopted as regards the analyses of the bulk samples of waste products :—

(a) *Pericarp residue.* The bulk sample was quartered until approximately $\frac{1}{2}$ lb. of residue remained. A small sample (25 grammes) was weighed out accurately, dried in a steam-oven and treated with petroleum ether in a Soxhlet extractor. When extraction was complete, the solution of oil in petroleum ether was filtered, the solvent distilled off and the oil dried to constant weight.

(b) *Nuts.* The bulk sample of nuts was quartered until approximately 2 lbs. remained. A sample (80—90 grammes) was weighed out accurately, dried

in a steam oven for a few hours and treated with petroleum ether in a Soxhlet extractor, until all the oil had been removed from the surface of the nuts. The oil was recovered by a similar procedure to that described for the pericarp residue.

(c) *Washing of crude oil.* 50 c.c or ml. were measured into a porcelain basin, evaporated to dryness and the residue dried in the steam-oven. The dried residue was ground with a small quantity of fine sand and treated with petroleum ether in a Soxhlet extractor until the oil was completely extracted. The oil was recovered by a similar procedure to that described for the pericarp residue.

(d) *Purification of sludge.* A similar treatment to that described for the water from the washing of the oil was adopted in the case of the layer of water separating out after further treatment of the sludge.

Calculation of Results.

In order to show the method of calculation, an example from an actual test is given. It will be noticed that the weight of oil lost at any particular stage of the process is calculated by multiplying the weight or volume of the waste product by the unit figure for the oil content as determined by analysis.

FRUIT				lbs.
Weight of fruit treated ...	...	...	...	8,243
PALM OIL				
Weight of oil recovered ...	...	...	...	2,221
LOSSES OF OIL				
(a) <i>Pericarp residue</i>				
(lbs. of oil per lb. of pericarp residue)				
(i) 1272 x .1041	...	...	...	132.41
(ii) 953 x .1091	...	...	...	103.97
(b) <i>Nuts</i>				
(lbs. of oil per lb. of nuts)				
(i) 1533 x .0048	...	...	...	7.36
(ii) 1390 x .0051	...	...	...	7.09
(c) <i>Washing of crude oil</i>				
(lbs. of oil per gallon of water)				
(i) 72 x .06	...	...	...	4.32
(ii) 48 x .09	...	...	...	4.32
(iii) 59 x .08	...	...	...	4.72
(d) <i>Purification of sludge</i>				
(lbs. of oil per gallon of water)				
(i) 65 x .08	...	...	...	5.20
(ii) 62.5 x .08	...	...	...	5.00
Total				274.39

EFFICIENCY OF PROCESS				per cent.
2221	×	100	222100	
=			=	89.0
2221	+	274	2495	
OIL CONTENT OF FRUIT				
2495	×	100		
=			=	30.3
		8243		

The results show that, commencing with fruit containing a small proportion of trash, approximately 89 per cent. of the total oil present in the fruit has been recovered.

The slightly low figure for the oil content of the fruit is due to the inclusion of the small proportion of non-oil-bearing trash. This point will be referred to again later.

Remarks and Conclusions.

Although only one example has been quoted it may be mentioned here that three tests, in which approximately the same amounts of fruit have been treated, have given similar figures as the following results show :—

Amount of fruit lbs.	Efficiency per cent.	Oil content of fruit per cent.	Remarks.
9,596	88.1	31.3	Clean fruit.
10,117	88.3	31.6	Do.
8,243	89.0	30.3	Fruit with trash.
12,622	88.4	30.4	Do.

It appears reasonable to assume therefore that the efficiency of the centrifugal process as described above is approximately 88.5 per cent.

Further, it will be realised that when commencing with fruit containing a proportion of trash the calculated figure for the oil content of the fruit is of little significance, unless the proportion of trash is known and the correct weight of fruit calculated.

As regards the distribution of the losses of oil, figures show that taking the total loss as 100 the percentage distributions are approximately as follows :—

	per cent.
Pericarp residue	87.4
Nuts	6.1
Purification of oil	6.5
	<hr/> 100.0

Assuming that the average oil content of the fruit is 31.5 per cent. it can be calculated that the final distribution of the oil is approximately as follows :—

					per cent.
Oil recovered	...	...	...	...	27.8
Oil lost in pericarp residue	...	...	...	...	3.3
Oil lost on surface of nuts	...	...	...	...	0.2
Oil lost in purification	...	...	...	...	0.2
					<hr/>
					31.5

General.

At present the yield of fruit from the area under cultivation is only sufficient to warrant the factory working two days per week, but with the greater productivity of the palms on account of increasing age and the extension of the area, the factory will have to be run more frequently to deal with the increased output.

In this connection it may be of interest to note that the weights of fruit treated and the amounts of oil recovered during the past four months have been as follows:—

Month.		Weight of fruit lbs.	Weight of oil lbs.	Recovery per cent.
March	...	41,648	11,257	27.0
April	...	63,283	17,182	27.2
May	...	39,835	10,929	27.5
June	...	41,459	11,242	27.1

The comparatively high figures for the percentage recovery of the oil are due partly to the fruit having been picked clean before weighing and partly to the loss of moisture occurring during storage in the collecting sheds and resulting in a lower weight being recorded for the fruit than would have been the case if the fruit had been treated fresh. In this connection it may be mentioned that the June figures recorded for the weight of fruit and the percentage recovery are not strictly comparable since during the last three weeks of that month the treated fruit contained a proportion of trash.

With regard to the quality of the oil the average acidity, calculated as palmitic acid, during the above period was approximately 4.45 per cent. As mentioned previously, the average moisture content was 0.22 per cent., while the matter in suspension was less than 0.01 per cent., being of the order of traces.

No comments can be offered at present on the quality of the kernels since manufacture has only commenced recently.

As far as can be judged the colour of the fresh kernels is satisfactory, occasional counts of the proportions of white and "off-colour" kernels show the latter to be present to the extent of only approximately 15 per cent. Average samples of kernels will, however, be taken for analysis when the first consignment is shipped.

IMPRESSIONS OF DANISH AGRICULTURE

BY

E. A. CURTLER,

Assistant Agriculturist.

The writer attended the International Dairy Congress at Copenhagen in 1931 as a delegate of the Straits Settlements and Federated Malay States. He availed himself of the opportunity thus offered of making some acquaintance with Danish agriculture. The following notes are compiled as a result of visits made to various places of interest near Copenhagen.

Over three quarters of the total area of Denmark is cultivated, the remainder being towns or land unsuitable for agriculture.

The land is divided into comparatively small holdings. Over 20 per cent. of the holdings are between 3.3 to 15 hectares each and a further 50 per cent. are of not more than 60 hectares.

The intensive cultivation of the land is usual. The cattle are tethered while grazing, the grazing being usually on fodder crops. Permanent pasture is seldom seen and rough pasture very rarely. Hedges are not grown.

The agriculturists are industrious, working practically all day in the fields.

Agricultural Museum.

The main objects of interest at the Agricultural Museum at Lyngby were the collection of implements and the graphs illustrating the progress of Danish agriculture.

The implements start from very primitive ploughs which were little more than pointed sticks hardened by fire and then show the gradual improvements that have been made from time to time.

The graphs illustrate the very considerable agricultural developments that have taken place during the last half century. The number of cows has been rather more than doubled and during the same period the average output of milk per cow has increased threefold. The quality of the milk has also improved, now containing four times the amount of butter fat. The average yield of milk per cow is now 7,300 lbs. containing 272 lbs. of butter fat.

The pig production has increased sevenfold, despite a large number having been killed during the war period.

Farm School.

A farm school was founded in 1887 by a number of local landowners, to give instruction in the theory of agriculture.

The farm school is run by the Director, who pays rent to the owners, and makes what profit he can from it. The school receives a state grant of approximately \$1,000 per annum and is inspected by officials of the Ministry of Agriculture.

The staff consists of five resident and eight part-time instructors. The subjects include general education, chemistry, physics, botany, bacteriology, soil management, animal husbandry, economics, testing and inspection of milk.

There is accommodation for 120 students, of whom usually 90 per cent. are farmers' sons. Students are about 20 years of age before they enter the school.

The courses all commence on the 1st November and last for nine, six and five months. There is also a special four months' course for students proceeding to the Royal Agricultural College, Copenhagen.

State Farm and Experimental Dairy.

The State Farm at Trollesminde was taken over for agricultural experiments during 1917. During 1923 a State Experimental Dairy was opened on adjoining land.

The control of each station is vested in a committee of Administration appointed by the Ministry of Agriculture.

The area of the farm is 547 hectares. The percentage of the area under each class of crop is approximately as follows:—grain 59 per cent., grass 24 per cent., roots 12 per cent., potatoes 3 per cent. and seeds 2 per cent. Grain includes areas used for cattle food. The term "seeds" in this connection denotes crops grown for the production of seed to be used as planting material and not such as clovers as the term is used in England.

The live stock consists of 389 cattle, 62 horses, 301 pigs and 968 poultry.

CATTLE. The herd consists of Jutland and Red Danish dairy cattle with some imported dairy Shorthorns.

The Jutlandish or Black and White Jutland dairy cattle are very similar to but slightly smaller than those bred in Holland and North Germany. The average yield is 7,800 lbs. of milk, containing 3.7 per cent. fat and 290 lbs. butter fat. This breed is chiefly found on the peninsula of Jutland.

Red Danish was only definitely established as a breed in 1878. It is a typical dairy animal, red or reddish brown, with a few white hairs in the switch and occasionally under the belly. The average yield is slightly better than the Jutlandish, being 8,927 lbs. of milk containing 3.8 per cent. of fat and 342 lbs. of butter fat.

Although both these breeds are primarily dairy cattle they fatten up to make a good grade of beef.

Previous to 1930, only Red Danish cattle were kept on the State Farm, but during that year, the other two breeds were introduced so that comparison of yields might be made.

Ordinary marked cows were purchased for the farm in the first instance. By the use of selected bulls and careful management and feeding during the last decade, the milk yield has been increased by over one-third, the percentage of butter fat by 0.45 and the yield of butter by two-fifths. The average yield is now, 7,600 lbs. of milk containing 3.98 per cent. fat and 382 lbs. of butter.

The main investigation with cattle at this farm is concerned with the effect of various concentrated foods on the consistency of butter. At the same time, the palatableness and digestibility of foods are recorded. This work is done in collaboration with the Experimental Dairy and results have been published.

The second important experiment is to compare the result of feeding (a) an excessive ration (b) a normal ration (c) an insufficient ration to heifers from birth till first calving.

PIGS. Pig keeping was not commenced till 1924 and was interrupted by a serious outbreak of disease during 1927. The main investigation is to ascertain the most economical ration which will give an increase of live weight from 45 lbs. to 200 lbs. as quickly as possible.

POULTRY. Two breeds of poultry are kept, Brown Italian and Cross-striped Plymouth Rocks. All eggs are laid in trap nests, the weight of each egg being recorded before the bird is released.

As a result of selection and controlled feeding, high-yielding strains of both breeds have been produced.

The effect of artificial light on the birds is also being recorded.

STATE DAIRY. In order to deal with all problems that arise, this institution is more fully equipped than an ordinary dairy. In addition to rooms for skimming, churning, butter packing, cream refining, cheese salting and pressing, there are chemical and bacteriological laboratories. It has its own power plant to drive the machines, cooling and lighting plants. The dairy deals with from 25,000 lbs to 30,000 lbs of milk daily.

The most interesting apparatus in the dairy was a "Stassaniser", invented by Dr. Stassens for pasteurising milk.

The apparatus consists of four superimposed cylinders, through which the milk is passed in tubes 1 mm. in diameter, where it is heated to 75°C. in about 20 seconds.

This process, which produces milk as pure from the bacteriological standpoint as high pasteurisation, has the following advantages :—

- (a) "Stassanised" milk does not differ from raw milk in taste or smell.
- (b) The process has no effect on the vitamins in the milk nor does it precipitate any of the albumen.
- (c) There is no loss by evaporation, which may amount to 1½ per cent. in the ordinary process.

Milk Supply Depot.

All the milk for the retail trade in Copenhagen is handled by the dépôt. It arrives in churns, which are taken up a lift and along a roller track to the automatic weighing machines. The milk is poured into the machines by hand. The empty churns are cleansed in a large steam washer before being returned to the farms.

The milk, to be bottled as such, is run in pipes to coolers and thence to large automatic bottling machines.

Some of the milk is run through separators before cooling. The separators produce various grades of skim milk, which is all bottled. Some of the cream is bottled for sale and the balance is used in the manufacture of butter.

The empty bottles returned to the dépôt are washed in large steam washers and are conveyed on roller tracks to the bottling machines. During the journey an examiner removes damaged and improperly washed bottles.

The roller track conveys the bottle round the cistern of the bottling machine, where they are automatically filled with the correct amount of milk and sealed with a crown cork.

The full bottles are then conveyed to the packing shed, where they are packed in crates covered with crushed ice, which is manufactured at the dépôt.

Co-operation.

Co-operative societies deal with about half the agricultural business of the country, so that co-operation may be described as the keystone of the agricultural prosperity of the country.

The land owners form Mortgage Credit and Hypothec Societies when they wish to obtain mortgages on their land. The larger area being a better security, they can obtain loans at a cheaper rate. The societies issue cash bonds up to three-fifths of the value of the land against an ordinary mortgage bond. The cash bonds are dealt with on the exchange, prices being quoted daily.

The loans are redeemed by annual payments, usually over sixty years. The cash bonds are redeemed by annual drawings.

The Royal Danish Mortgage Bank, working with a state bond as its constitutional capital, takes up the mortgage bonds from the societies and issues its own cash bonds.

Co-operative societies deal with almost every phase of agricultural business. They facilitate the maintenance of the joint interests of the farmers and provide for the economies resulting from large scale production.

Each society usually strictly confines itself to its own particular business. Membership is open to any farmer and every member has an equal vote in the management of the society. The profits are divided in proportion with the individual member's turnover.

The various organisations have developed independently without intervention by government or other outside assistance. They are all members of the Union of Danish Co-operative Societies.

Co-operative slaughter houses handle 84 per cent. of the pigs killed for export. They are organised in a national union which runs a joint sales company in London.

Other societies deal with egg exporting, cattle exporting, seed supply, purchase of feeding stuffs and purchase of manures. These societies are not as strong as the two first mentioned.

In closing, the writer desires to take this opportunity of recording his personal appreciation of the hospitality extended to him while in Denmark.

DISEASES OF THE PIG*

BY

T. D. MARSH,

Assistant Agriculturist.

In a well conducted piggery very many of the diseases hereunder mentioned will never be encountered.

In the tropics cleanliness is essential to prevent the establishment of parasites both internal and external and a daily bath is strongly recommended.

The most dangerous disease in Malaya is swine fever which is briefly described. Outbreaks of this disease and swine erysipelas must be notified to the nearest Veterinary Officer.

Swine Fever.

This disease is also known as hog cholera, it is very contagious and may be introduced in contaminated food, or may be carried on the boots or clothing of persons who have been in contact with diseased animals; the infection may be transferred by blood, excrement, saliva or discharges from the eyes, nose and skin.

Symptoms. The affected animal is dull with a high temperature and quickened breathing, a red rash develops inside the thighs, on the belly and behind the ears. The rash later extends to other parts of the body; the animals often have difficulty in walking about. The acute form of the disease is very rapid and usually ends in the death of the affected animal in about three days. Cases occur which have milder symptoms, the disease develops more slowly, and in others the lungs become affected.

An outbreak of swine fever usually results in the death of all the animals in the piggery. There is no treatment; slaughtering of diseased animals and vigorous disinfection of the premises is recommended and unless the quarters are well built, so that they may be thoroughly cleaned and disinfected, it is better to move the piggery. It is not advisable to use disease polluted land for grazing pigs for several years after an outbreak. Inoculations of a serum are used as a preventative in temperate climates to immunise animals. Protection against the disease only lasts for a few days, but should inoculated pigs be affected with the disease the attack is mild and a permanent immunity in many pigs results.

Some pigs apparently can be immune and yet carry the disease without any symptoms. It is probable that such animals periodically introduce the disease into Malaya when imported for slaughter.

* The following is the second article dealing with pigs in Malaya. The first article appeared in the August number of this Journal. A further article on The Pig Farm at Serdang will be published next month.

Swine Erysipelas.

This disease is often confused with swine fever although it is stated to be quite distinct.

Symptoms. A redness of the skin behind the ears which very soon covers the whole body, afterwards turning to purple. The disease causes the death of affected animals in from one to two days.

Trichinosis.

This disease of pigs is caused by a Nematode, *Trichina spiralis*, which is a small worm that gains access to the pig's body by the animal eating flesh containing the parasites. The worms are very small and become embedded in the muscles. It is not usual for this parasite to cause much sickness in the pigs, but it is fairly common and also affects man; the safeguard against infection in man is to cook thoroughly all pork before it is eaten.

The following chart of common diseases that affect pigs is an abstract from the *Queensland Agricultural Journal* Vol. XXXVI, Part 1, of July 1931 by E. J. Shelton.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Abortion.</i> The premature birth of the foetus, due to injuries, exposure to cold, use of mouldy food; infection of the breeding organs by septic germs is also a frequent cause.	The expulsion of the foetal pigs, which is sometimes preceded by a discharge.	Comfortable and clean conditions, quiet handling and good food help to prevent abortion. Affected sow should be isolated and the uterus flooded with a solution of 20 grains of permanganate of potash to 1 gallon of water to be followed by a douche of 1 teaspoonful of salt to 1 pint of water for five days.
<i>Bronchitis</i> is an inflammation of the bronchial tubes, the actual causes being germs, worms or dust; predisposing causes are damp, dusty, and insanitary conditions.	A persistent cough and slight fever with a progressive unthrifty appearance.	Provide sanitary and comfortable accommodation, use clean bedding in cold weather, give nourishing and laxative diet, milk, green food, and a little meal. Molasses helps to keep the bowels open. One dessertspoonful of Epsom salts with equal amounts of sulphur in the molasses daily for three days for is advised. every 100 lb. body weight

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Indigestion.</i> A digestive disorder caused by improper feeding, coarse fibrous foods, weak washy swill, or foods in a decaying or mouldy condition.	Loss of appetite, constipation or diarrhoea; tucked up appearance in the belly.	See that troughs are clean, change the food to rectify the fault, and give in the food a dose of castor oil, 1 or 2 ozs. of oil to each 100 lb. weight of pig. Use light nourishing foods in well-balanced rations.
<i>Inflammation of the Udder.</i> A disease of the udder, caused through injuries, or through suckers not relieving the sow of her milk.	Udder is hot, hard, and painful; sow refuses to allow pigs to suck.	Remove cause when possible, apply hot water forments to udder, massage the udder, using olive oil; give 2 ozs. of castor oil in food. The massage of the udder is important. Use only light laxative foods and compel sow to take regular exercise.
<i>Intestinal Worms.</i> Several species of worms are found in stomach and intestines. Large round worms (Ascarids) are most common.	General debility, scouring, failure to make satisfactory gains in weight. The worms may be seen in the droppings and on post mortem examination.	Chief control measure is strict sanitation. Provide fresh pastures. Remove droppings and rubbish, clean troughs frequently, fill up all bog holes. Feed pigs on a laxative diet. Starve infested pigs for one day, then give in a small feed of milk half-a-teaspoonful of turpentine and 2 tablespoonfuls of castor oil for each 50 lbs. weight of pig. Repeat a fortnight later. Worm capsules may be used in the treatment of the parasites.
<i>Kidney Worms</i> are an internal parasite which gain entrance through the mouth when pigs eat from unclean troughs and floors. They affect kidneys, liver, and other organs of the body.	General debility, pig tucked up in the belly, sometimes a staggering gait, general unthriftiness of the animals and failure to make satisfactory growth.	Eggs of worms are passed out with urine and the embryos hatching from the eggs are eaten by pigs. Sanitation is the chief control measure, administration of medicine is not recommended as these worms are not removed by medicine once embedded in organs of the body. Fill up mud holes, clean troughs frequently, and provide a rotation of grazing paddocks.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Lousiness.</i> Infestation by the common hog louse (<i>Hoematopinus</i>) which is a blood sucking parasite of the skin.	Pig rubs against posts. Skin irritated and may be scurfy and sore. Lice and nits may be seen on skin and hair.	Spray or wash pigs with a mixture composed of a half-a-pint benzine, half-a-pint kerosene and 7 pints of waste oil repeat application in three days and then one week after. Apply petroleum jelly or coconut oil to the skin. Provide a rubbing post around which is wrapped a strong bag firmly fixed and soaked in oil.
<i>Mange.</i> An infection of the skin, caused by the tiny mange mite burrowing into the tissues.	Irritation and scurfing of the skin. A reddened appearance not unlike severe sunburn.	Wash pigs thoroughly with a weak solution of coal tar disinfectant, solution all wood work and floors.
<i>Necrotic Enterites.</i> A serious disease caused by a germ which affects the lining membranes of the intestine and is responsible for the resultant inflammation.	Loss of appetite, increased thirst, fever, arching of back, diarrhoea; death usually occurs in a few days.	Prevention lies in clean and comfortable quarters and good, wholesome food, isolate affected pigs, destroy those that are seriously affected. Clean up and disinfect piggery. Change food to a light nourishing diet.
<i>Paralysis of Hind-Quarters.</i> Cause often obscure and may be rheumatism, constipation, accident, kidney worms, lack of or deficiency in essential food elements.	Paralysis may be preceded by a wobbly gait and "marking time" with the hind feet, or it may be sudden. Pig eventually loses control of hind-quarters, and drags the hind legs.	Remove any visible cause; feed plenty of green food and minerals, do not overfeed with maize. Allow pigs to graze in paddocks. When pigs are affected have them slaughtered under inspection at an abattoir or bacon factory, and follow the advice given by the official carrying out the examination.
<i>Piles.</i> Protrusion of the rectum, caused through constipation and bad feeding. Overfeeding on milk products like buttermilk and whey is often responsible.	Constant straining, resulting in portion of the rectum protruding out past the anus. This is a very objectionable and serious complaint.	Isolate affected pig. Remove cause and give doses of castor oil. Wash protruding part in a weak disinfectant solution. Apply olive oil. Manipulate it back into place with the hands, reduce ration for a few days. If ration is cut down pig makes a good recovery if only 2 inches protrudes.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Pneumonia.</i> Infection of the lungs by germs following exposure to cold, damp, and draughty conditions, and other predisposing causes such as lack of nourishing food and defective sanitation.	Loss of appetite, difficult breathing, coughing, nasal discharge, fever, and is specially noted by short jerky breathing and lack of appetite.	Provide clean and comfortable accommodation and bedding in sheds in cold or wet weather. Prevent draughts on pigs when camped in shed, run pigs in lots of less than 12. Isolate affected pigs, give a light nourishing diet such as whole milk. Destroy badly affected animals. Disinfect pens and troughs.
<i>Poisoning.</i> Due to eating arsenic, common salt, and other chemical poisons. Poisonous plants and weeds are also often responsible for fatalities.	Staggering gait, vomiting, abdominal pains, diarrhoea. Death sometimes sudden, sometimes there is a lingering illness.	Find cause of poisoning and remove it. Give purge of Epsom salts or castor oil. If the poison is known, give an antidote—antidote for arsenic is the anti-arsenic drench. Send specimens of suspected poisons, plants or weeds for identification and when posting send a complete report to the Dept. of Agriculture.
<i>Rheumatism.</i> An affection of the muscles, caused through pigs lying on cold damp floors.	Intermittent lameness, swelling of joints, soreness of muscles.	Dry and comfortable sheds with a good sleeping floor; cement floors should be covered with wood. Use also clean straw bedding, particularly in cold and wet weather.
<i>Rickets.</i> A disease of the bones of young animals, due to a deficiency of essential food nutrients, and to other causes such as neglected breeding, in-breeding.	Hard swellings at joints of bones, malformation of bones, staggering gait. Pigs affected are usually stunted in growth and make but little headway.	Allow pigs to graze on good pasture in clean paddocks. Do not feed too much maize or other concentrated grain foods. Always include some legume crop in the ration. Give pigs a supply of mineral food, such as charcoal, ashes, bone meal, and lime. Well-balanced rations in liberal supply with plenty of clean drinking water is very necessary.

DISEASE, NATURE AND CAUSES.	SYMPTOMS.	PREVENTION AND TREATMENT.
<i>Diarrhoea, White or Yellow Scours.</i> Common in young pigs suckling the sow. Due to overfeeding, bad foods, insanitary conditions, cold draughty sties; too liberal feeding of the sow is often the predisposing cause.	Frequent discharge of watery faeces of a strong smelling characteristic odour; pigs lose condition and fall away; deaths often result.	Clean up piggery and troughs, reduce sow's food supply considerably for several days; give the sow and affected pigs a dose of castor oil and add lime water to the food. Careful feeding is essential, clean up thoroughly, disinfect sties and floors, remove to clean pens and use plenty of clean, dry bedding.
<i>Sore Mouth or Bull-Nose.</i> A disease of young pigs caused by a germ and always associated with filth.	Swellings and sores on the nose and mouth, and general unthriftiness.	Clean up piggery and troughs, and use a disinfectant; allow sunrays to get into the shed and trough. Dip the pig's nose into a solution of permanganate of potash. This solution is prejudicial to eyesight as it destroys the cement substance of the cornea.
<i>Cannibalism—Sows eating their Young.</i> Caused through nervous excitement or the lack of some essential food element. It is sometimes hereditary and indicates a nervous temper.	Sows eat young pigs soon after they are born. It is usual for a sow to eat her afterbirth if she is permitted so to do, but it is unwise to allow her to have access to it.	Give pregnant sows good grazing, give them protein rich foods such as milk, meat meal or legumes. Handle sow quietly at farrowing time. It is usually advisable to butcher a sow that has once eaten her young. Properly balanced rations in limited supply at farrowing time is essential; correct methods of management are advised especially at this time.
<i>Tuberculosis.</i> A contagious disease caused by a germ.	Symptoms in the early stages are practically nil, in the advanced stages wasting of the body. Many pigs that are condemned show no external symptoms at all.	Pasteurise all milk product before feeding to pigs. Boil all meat before feeding to pigs. Disinfect troughs frequently, keep pigs in large, clean, and dry quarters. Destroy all pigs suspected of being tubercular. Get in touch with a Veterinary Officer immediately for advice as to how to proceed.

Abstracts.

PINEAPPLE NOTES

The Pineapple Industry in Formosa.

The area under pineapple in Formosa in the year 1931 was 12,322 acres, a decrease of 300 acres since 1930, while its export during the same year amounted to 2,008,586 dozen tins. The entire tinned pineapple industry is controlled by a series of rigid governmental regulations with which any person desirous of engaging in this industry has to conform before he can obtain permission to commence operations.

In 1930 there were eighty-three pineapple canneries in the island; there has recently been formed a Joint Sales Company, all the members of which are required to sell their produce through the Company, which, it was hoped, would then be in a position to control prices in Japan, which country absorbs over 2,000,000 dozen tins of the total output, and to eliminate wasteful competition in the purchase of fruit from the growers, while the latter were expected to benefit from the assurance of a steady market for their produce.

Variety of Pineapple for Canning.

Goods for export are manufactured chiefly from "Smooth Cayenne" from Hawaii and the "Sarawak" variety from Borneo.

It is interesting to note that the "Sarawak" pineapple is never used for canning in Malaya, it being considered too brittle in texture and too pale in colour, also the fruit is of such a shape that its cutting into "slices" for canning is a wasteful process. At the request of the Department of Agriculture, S.S. and F.M.S., samples of this variety were canned by a Singapore firm and sent to the Malayan Information Agency in London through whom trade reports on their quality were received.

In spite of the fact that a shorter period of cooking than is normal had been employed in the preparation of this fruit, in order to overcome its tendency to become "mushy", a somewhat adverse criticism was received. The first sample tin was found to be slack filled, the fruit lacking the deep yellow colour preferred in the United Kingdom in Malayan fruit, and inclining to "mushiness" owing to over-ripeness or over-cooking: its flavour although good was not very pronounced, attributed in part to the heavy syrup. The contents of the second tin opened were said to be of very poor quality, about equal to that of 2nd grade Singapore, the cubes having the whiteness of unripe pines and emitting a sour odour.

The report further states that the fruit is softer and less stringy than "Queen", adding that there is a tendency in all Malayan packings for the flavour to be somewhat obscured by the sugar as compared with Honolulu and Australian packs, where possibly a certain quantity of pineapple juice is added, which may be lacking in the Malayan product.

THE WORLD'S SUPPLY OF RICE.

A recent publication of the Empire Marketing Board* contains a valuable summary of the areas, production, exports and imports of rice throughout the world.

The total area under rice in the season 1930—31 was estimated to be 139.12 million acres, of which 60 per cent. was contained within the British Empire. (These figures exclude China). Of this total, no less than 81.99 million acres are in India.

World production in the same season is estimated at 88.38 million tons, while the average annual world production (excluding China) between 1926—31 was 85.28 million tons of rice of which 47.62 million tons is produced in the British Empire. China's production is estimated to be about 50 million tons.

India, the largest exporter in the world, exports about 5 per cent. of its crop. Foreign countries, apart from China, although producing considerably less, place a large proportion of their total crop upon external markets.

The exports of rice from the chief exporting countries (in thousand tons) in 1930 were :—Indo-China 1,009, Siam 920, Korea 688, Formosa 293, Italy 211, United States 95, Spain 56: Of Empire countries, India 2,625, British Guiana 22.

The importance of rice in export trade in certain countries is shewn by the fact that the relative value of rice exports to total exports (percentage rice to total) of India is 10 per cent., Siam 67 per cent. and Indo-China 63 per cent.

The great bulk of the surplus rice is distributed amongst neighbouring countries in the East. Of the rice exports of India, 25 per cent. go to China, 17 per cent. to Ceylon, 14 per cent. to British Malaya, 10 per cent. to Netherlands India and 14 per cent. to the United Kingdom, Poland and Germany. Of Siam's exports of white and broken white rice, 39 per cent. went to British Malaya in the 1930—31 season, 27 per cent. to Hongkong, 10 per cent. to Japan, 9 per cent. to non British West Indies, and 8 per cent. to Netherlands India. The other large exporter, Indo-China, exported the following cleaned rice: 28 per cent. to Hongkong, 19 per cent. to China, 12 per cent. to Netherlands India, 20 per cent. to France, 4 per cent. to French Colonies and 3 per cent. to Japan.

It is seen that the imports of Ceylon and Malaya effect to a large extent the exports of India but still leave the Empire a net exporter of rather more than a million tons annually.

* Grain Crops.—A summary of figures of production and trade relating to Wheat, Wheat Flour, Barley, Oats, Maize, Rice, Rye. Empire Marketing Board 1932. H. M. Stationery Office, London W.C.2 Price 6d. Net.

Reviews.

The Cultivation and Manufacture of Tea in Ceylon and India.

E. A. Curtler, Special Bulletin, General Series No. 9 Department of Agriculture, S.S. and F.M.S. 1932. 94 pp. 10 illustrations.

Price \$1. (Straits Currency).

This publication is a summary of the information collected by the author in the course of a tour of duty to Ceylon and India, undertaken in 1930 for the purpose of acquiring the most recent information on the subject of tea cultivation and manufacture as practised in these countries.

The bulletin is in two parts, the first dealing with the cultivation of tea in Ceylon and India and the second with the manufacture of tea in these two countries.

While the cultivation and manufacture of tea follow the same general principals in all countries yet the procedure varies according to climatic and other conditions. Frequently such variations are noted between adjoining estates. It follows therefore, that no account on this subject can cover or be applicable in detail to the cultivation or manufacture of tea in any other place. The author emphasises this point and recommends that very detailed records be kept of all work in field and factory so that the correct procedure may be ascertained and any seasonal variations adversely affecting the quality of the produce may be countered both in the field and the factory.

Most readers will be aware of the general cultural methods which form an integral part of the cultivation of any tropical crop. One's experience, for instance, and the literature now available on methods of preventing soil erosion make a very detailed account of this subject unnecessary in a publication of this nature. On the other hand, methods of cultivation peculiar to the crop under discussion merit closer attention, while on such subjects as manuring, pruning and plucking, the reader will desire full particulars concerning modern methods which are the outcome of many years of estate practice.

The author maintains a correct balance in his treatment of the various stages in the establishment of a tea plantation, bearing in mind that he writes, not for the general agriculturist or for the tourist, but rather for the experienced planter who particularly looks for details of modern methods of treating this crop. It is thus seen that in this account, while soil erosion is given but one page, cover crops three, drainage less than three, yet prominence is given to such subjects as manuring, pruning and plucking.

Throughout the bulletin, frequent comparisons are made between methods employed in Ceylon and India. The indications of the reasons for such variations will assist the reader in the application of the principles involved to the conditions peculiar to the site where he may propose to cultivate this crop.

The reader of the Special Bulletin will recognise that with all the knowledge that he may acquire on tea estates in other countries, and by reading literature on the subject, ultimate success in a new environment will depend

upon a quick appreciation of local characteristics which affect the product and a realisation of the extent to which he can introduce innovations applicable to local conditions.

It is probable that Mr. Curtler's account will satisfy the growing demand in Malaya for the most recent information on tea production in neighbouring countries especially in view of the increased attention that is being given to this crop in the Highlands of this country. The additional fact that the author is stationed at Cameron Highlands should be of value to those developing tea plantations in this area.

D. H. G.

Oil Palm Products.

Survey of Vegetable Oilseeds and Oils Vol. I Oil Palm Products. Empire Marketing Board. 130 pp Illustrated H. M. Stationery Office, June 1932. Price 1s. net, postage extra

Those who have invested capital in the development of oil palms estates and also prospective investors in the industry have for some time past desired a publication which would give in detail, information on the production of palm oil and kernels in other countries, the markets for these raw products and the uses to which they were applied. With such information the capitalist and planter would be in a better position to envisage the future of the industry and thus be enabled to decide as to the prospects of further development in the production of the high quality palm oil which is obtainable under the plantation system.

The recent volume compiled by the Empire Marketing Board will be found to fulfil the wishes of the investor in these respects. In the course of their investigations the Board found difficulties in estimating the degree of substitution of competing oils used in certain important industries. In consequence, the reader is promised a further volume from the same source which will carry these investigations to more definite conclusions than are possible by consideration of this one product.

The present volume, however, in four chapters, gives a complete survey, country by country, of the production and export of palm oil and kernels, the principal markets to which each are sent and the fluctuations of price from year to year.

The exports of both palm oil and kernels increased considerably in post-war years. The average annual exports of kernels over the period 1909—13 was 317,044 tons and of palm oil 121,906 tons, while the 1930 exports were 554,468 tons and 272,661 tons respectively.

Bearing in mind that the palm under plantation conditions, yields about 16 cwts. of palm oil to 4 cwts. of kernels, one is struck by the relatively small quantity of palm oil which is exported in comparison with the large amount of kernels which find their way to the world's markets. The apparent discrepancy is explained by an investigation of conditions of production in the chief African

producing areas from which source 189,400 tons of oil is exported, whereas based on a fruit content of 13 per cent. palm kernels and 22 per cent. palm oil, the potential production of palm oil is 712,000 tons. The balance of the 712,000 tons is put down as domestic consumption, waste and residue impossible of extraction.

The potential export of this large quantity of palm oil from East Africa is a subject of very grave importance to producers of the plantation product, for the latter must feel that at some time or other, and especially if a period of better prices is realised, a sudden increase in exports of native-produced oil from Africa may result. The greatest potential producer is Nigeria. In discussing this question in Nigeria, we are told,

"Palm oil is largely used by the natives for cooking purposes and as an illuminant, and the kernels are regarded by them as a bank to be drawn upon in times of need. Hence a period of low prices will result in a material decrease in output both of kernels and of palm oil, owing to the lack of sufficient inducement to undertake the labour of harvesting and preparing larger supplies than are needed for home consumption; at such times only part of the crop is harvested, the rest being left to rot on the trees".

Efforts have been directed by educational methods to increase production and improve quality, and while some success has been achieved, it is stated that progress must necessarily be slow. Almost the whole of the Nigerian exports of palm oil are the product of native labour, the oil being extracted by slow and wasteful methods. The few small factory mills which have been established have not proved very satisfactory owing to opposition of the small traders, irregularity of supply and difficulty of transport of the fruit.

At present, improvements are directed in the following channels (a) thinning and re-planting in natural palmeries, (b) subsidies to erectors of small mills, (c) bulk handling of oil at ports and (d) Government supervision and inspection with a view to improvement of quality and grading of the product.

Efforts are being made in the British possessions and also in the important French, Belgian and Portuguese colonies in Africa to increase the export and improve the quality of palm oil, the methods used depending upon the particular aspects of the problem which apply in each instance. Ultimately, these efforts must result in improvements in the directions desired, although at the moment they have but little visible effect on the exports.

It appears probable that provided the price of palm oil reaches no abnormally high level, and that there is a satisfactory extension of the market, there is little danger of the African product swamping the market and thereby rendering the plantation production unremunerative.

Such provisos necessarily direct our attention to present markets and possibilities of future extension of the market.

Palm oil finds its chief uses in soap making, the tin plate industry, margarine and edible oils. Palm oil is an important constituent in the manufacture of

soap, but substitutes, such as whale oil, are now largely employed in this connection. The utilisation of palm oil in this industry is thus largely a question of price in competition with substitute oils. It is held, however, that palm oil still finds its principal outlet in the manufacture of soap. In this connection it is pointed out that the increased import of palm oil into America (from an average of 27,000 tons per annum between the years 1909—13, to 128,000 tons in 1930) was coincident with an increase in the production of soap in that country.

In the tinsplate industry, palm oil has been found to give the best results in the so-called "pickling" process of manufacture, but there appear to be no very considerable extensions probable in this direction.

The amount of palm oil used in the manufacture of margarine and edible fats is small. The publication gives no reason for this fact, and in view of the suitability of high quality palm oil for such purposes, it is probable that this industry provides the most promising outlet for the oil produced from plantations in Malaya and Netherlands India.

The publication, after noting the decline in the candle industry, states that a new field for palm oil may be provided by its utilisation as a fuel for Diesel and semi-Diesel engines.

"Experiments have been attended with some success but no commercial development has ensued where other fuels are available at low cost. In the Belgian Congo, where petrol is relatively dear, palm oil has been successfully substituted for utilisation in special motors, and much satisfaction has been evinced at the results obtained in the case of heavy transport vehicles. Not only has the cost of transport been thereby substantially reduced but the inconvenience attaching to the use of highly volatile fuels in countries of high temperature has been obviated. As yet, this form of utilisation is still largely in an experimental stage and has no great commercial importance. Its potentialities should, nevertheless, not be overlooked, and it may possibly provide in the near future an important outlet for palm oil consumption."

The reader is referred to the original publication for much valuable information on palm kernels and on the reasons for the fluctuations in price of the two products of the oil palm. We are chiefly concerned with the possibilities of the Malayan product. The future is necessarily somewhat uncertain, but there appears every reason to assume that edible oils have an important future, and it is as an edible oil that we consider that the plantation product will hold its own by reason of its purity and price in comparison with its competitors. One of the main reasons for this contention is that with such a product as palm oil the manufacturer can be sure of future supplies at steady prices whereas with many of its competitors—which are annual crops—production and consequently price, depend largely on seasons.

The Empire Marketing Board concludes this first volume in the following words :—

"The cultivation of the oil palm will no doubt continue to expand steadily as the new areas in British Malaya and the Dutch East Indies are brought into full bearing and as improved methods of cultivation and harvesting materialise in the older areas in West and Central Africa. The future supplies of oil palm fruit are therefore assured and the outlook for the industry will depend mainly upon the growth of demand for palm kernel oil and palm oil. The demand for these products in turn mainly depends on the one hand on the growth of the soap and candle and of the margarine and other edible fat industries and on the other hand on the competition of other vegetable oils and fats and animal and marine fats utilised in these industries.

"The expansion of these industries, more particularly that of soap, should continue with the general increase in population and with the continued rise in the standard of living. As regards the substitution of one fat for another in these industries the prospects are not so easy to define. Substitution is primarily dependent upon the special properties which the competing fats possess and with the widened uses for inferior oils brought about by improvements in technical processes. But price considerations also play an important part and over a relatively short period the price factor is probably the more potent. In this connection the efforts that are being made to improve the productivity of the oil palms and to increase the oil content of the fruit should result in a lowering of the cost of the product, while the increasing importance of factory production which now accounts for about 25 per cent. of the volume of palm oil entering world trade as compared with less than 5 per cent. in 1920 should also tend in the same direction. But it remains to be seen whether the reduction will be sufficient to permit of more effective competition with other oils and fats such as coconut oil, groundnut oil, cottonseed oil and whale oil, which are the principal oils entering into competition with the products of the oil palm."

D. H. G.

Malayan Rubber Statistics Handbook, 1932.

*Compiled by the Department of Statistics S.S. and F.M.S. Government
Printing Office, Singapore. Price \$1.50 (Straits Currency)
post free.*

The title of this publication is somewhat misleading as it infers that the information contained therein concerns 1932 rubber statistics, whereas in point of fact it is a record of Malayan acreage planted annually with rubber trees to the end of 1931 and of Malayan statistics of production, imports, exports and consumption of rubber for the year 1931.

The publication has been extended somewhat from the previous edition by the inclusion of statistics relating to ownership of rubber estates, production rates, average areas out of tapping, average market price of rubber and a graph

of daily market prices of rubber in 1931. Certain other tables give greater detail than did the corresponding tables in former editions.

The Handbook is a most useful compendium of statistical information on the Malayan rubber producing industry.

D. H. G.

Coffee.

Nineteenth Report of the Imperial Economic Committee. H.M. Stationery Office, London, 1931 6d net plus postage.

The cultivator of primary products to-day must be something more than one who can coerce a good harvest from the soil. Especially in times like the present, when the margin between profit and loss is narrow, businesslike methods of costings are essential.

Furthermore, the producer must study the world demand respecting grade and quality, and in this matter he may find guidance from the constant flow of inexpensive literature published by various public bodies.

The Imperial Economic Committee has already published nineteen reports, twelve of which deal with the preparation for market and marketing of food-stuffs and raw materials produced within the Empire.

Coffee, the latest report of the series, deals adequately with the subject, giving special emphasis on the effect of increased production on different grades of coffee, cultivation and preparation, coffee producing areas in the British Empire, research, evaluation and marketing methods, besides a number of factors to be taken into consideration in order to judge of future prospects of the industry. The twenty-six tables and one chart which form the Appendix to the Report give all the essential data regarding production, consumption and prices. The reader is even told how to prepare the beverage.

It is not proposed in this place to give a detailed review of this publication. To do so would be to reproduce most of the 68 pages of the Report, for the publication in itself is a condensed statement of the subject. It is, however, suggested that agriculturists should make a close study of this most readable report before embarking on any new coffee project, so that they may be cognizant of the demands of the consumers in different parts of the world, which are necessarily reflected on the grades recognised by the Trade.

D. H. G.

Departmental.

FROM THE DISTRICTS.

The Weather.

In general, the first half of August was dry and the second half wet. In Kelantan, Province Wellesley, and the coastal parts of Malacca, the rainfall did not commence until the end of the month. In Kedah and Pahang the whole month was fairly dry, especially on the East coast of Pahang, as it was also in the Tampin District of Negri Sembilan. In the northern half of Perak, with the exception of Krian District, the weather was wet, especially in the second half of the month. In Singapore island though the rainfall was low, conditions were damp and cool.

Remarks on Crops.

Rubber.—There was a further well marked rise in the price of rubber during August. Smoked sheet from small-holdings sold for \$5.00—\$11.00, unsmoked sheet for \$4.40—\$9.00, and scrap for \$1.00—\$5.50 per pikul. In Singapore the corresponding prices were \$9.20, \$7.70 and \$3.00 per pikul.

Owing to this rise in price tapping was again commenced on a number of holdings on which it had been discontinued for some time. This was particularly noticeable in the Settlement of Penang, Southern Perak and Pahang. As a general rule, however, holdings owned by Malays were not retapped in areas where padi planting work was in progress, while in Selangor and parts of Johore the rise in price did not restore confidence in rubber, though if it is continued, retapping will undoubtedly become more general.

Recent hot dry weather caused a heavy secondary wintering during the month in the States of Pahang and the Negri Sembilan. In the latter a fairly general but mild attack of leaf mildew, *Oidium Heveae*, occurred on the young foliage.

Mouldy Rot was in evidence in areas where the weather was wet and proved difficult to control owing to the inability of many owners of small holdings to provide the purchase price of even the cheapest disinfectants.

Padi.—The price of padi remained unchanged, ranging between 6½ and 15 cents per gantang in different parts of the country. The work of preparing the land and transplanting from the nurseries was delayed by dry weather in parts of Kelantan, the whole of Province Wellesley and the coastal portions of Malacca, as well as in the coastal portion of Krian District where a heavy growth of weeds in the canals had impeded the flow of the water. Drought also checked growth of the padi in the country bordering on the Pahang river.

Leptocorisa acuta, the padi fly, and birds did a little damage to the flowering inter-season crop in Selangor, but on the whole a good yield was anticipated.

In one of the two localities in the Dindings the co-operative construction of a bund by local padi growers was nearing a successful completion, but in the other the Malays lost interest and discontinued the work. In Province

Wellesley a bund was successfully repaired and increased in height by similar co-operative work.

In Malacca a further 275 gantangs of seed of pure strain padi brought the total distributed up to 3,200 gantangs. In Kedah 1,017 gantangs of selected seed were distributed in exchange for local mixed padi, while a further amount of 125 gantangs was distributed in Province Wellesley.

Coconuts.—Malays in the Settlement of Penang evinced an interest in the preparation of copra and sought advice on the construction of the improved type of kiln. This movement was a direct outcome of the visit of the Rural Lecture Caravan.

A movement in the same direction was initiated by the Principal Agricultural Officer, Johore, in the Batu Pahat District where a well attended meeting of the leading Malay owners of coconut holdings was held towards the end of the month.

In Selangor there was a steady improvement in the quality of the copra produced by Malays and several additional kilns were constructed. This development has attracted the attention of certain large buyers who are offering improved prices if copra of good quality is forthcoming in sufficient quantity. Progress in copra manufacture by the Malays of Bagan Datoh District was also recorded together with a rise in price.

A number of Malays in Kuala Langat District of Selangor have commenced preparing their own coconut oil which they sell at the local fairs for 13—14 cents per quart bottle. Oil is also made locally in the Pekan and Kuantan Districts of Pahang and sells at prices varying from 12—20 cents per bottle.

One Malay in Kuala Selangor District is manufacturing soap from coconut oil which he makes from his own nuts. The quality is, however, poor at present owing to faulty manufacture; advice on improving it has been given.

Small but severe outbreaks of the caterpillar pest *Artona catoxantha* were found at Siputeh in Kinta District and Sungei Buya in Kuala Langat District.

Although there have been local improvements in the price of small-holders' copra, the general range of prices was the same as in July, namely \$3.80—\$5.50 except for copra of the worst quality which realised as little as \$3.00 per picul.

Tobacco—Interest in this crop is well maintained and a number of small plots are continuously being planted in all parts of the country. The Chinese gardeners practise a rotation of crops, following tobacco with beans and then root crops, ground nuts or vegetables. In consequence, the area planted by them varies considerably.

An area of 200 acres in Perak North and another of 105 acres in Johore are being planted for production on a larger scale.

Prices for the better quality leaf ranged from \$20 to \$40 per picul, except in Pahang where they were \$30 to \$64 per picul. Second quality leaf sold for \$7 to \$20 per picul and cut tobacco from 50 to 96 cents per kati generally and up to \$1.20 per kati in Pahang.

Pineapples.—As supplies of fruit were no longer available most factories temporarily ceased working.

Two large areas aggregating 5,200 acres were being planted with pineapples as a sole crop in Johore where a further 5,000 acres for the same purpose were recently alienated.

Fruit.—The season for local tree fruits terminated at the end of the month after good crops of langsat, rambai and duku had been obtained in Province Wellesley, Jack fruit and rambai in North Perak and of duku in Johore.

In Selangor durians and rambutans were flowering and in Pahang East mangoes and pulasans.

Cloves.—Clove trees in Penang Island were coming into bearing and showed promise of a good crop. Existing trees were mulched and a considerable number of young seedlings were planted.

Agricultural Stations and Padi Test Plots.

KELANTAN. *Pasir Puteh Padi Experiment Station.*—At this wet padi Station sixteen varieties are being tested in replicated plots, while a manurial experiment has also been commenced. The Station suffered from drought to an extent which rendered cultivation impossible, but this difficulty was overcome by installing an engine and pump to deliver water from a roadside drain.

Kota Bharu Experiment Station.—At this Station varieties of dry padi are under trial. Weeding and mulching were carried out. In spite of lack of rain all varieties made good growth.

PERAK. *Kuala Kangsar Agricultural Station.*—A crop of Virginia tobacco was harvested. It was found that plants which had been grown under the shade of cheese-cloth did not show any superiority in growth and leaf texture over the unshaded plants. The crop suffered badly from Wilt Disease, *Bacterium solanaccarum*, which is prevalent in the soil of this Station. A fair crop of maize was also harvested.

SELANGOR. *Panchong Pedena Padi Test Station.*—The jungle on this new Station was felled and burnt. Stumping and clearing were in progress. Similar work was undertaken on a site for a small subsidiary demonstration and test plot at Sungei Derani in another part of this new padi area.

Work on other Stations and Plots proceeded normally.

Village fairs were started in 12 new centres during the month. These included one in Malacca where such fairs have not previously been held. These fairs not only enable local growers to dispose of the produce of their land at reasonable prices, but they also encourage village industries as is shown by the fact that baskets from Port Dickson together with walking sticks and tables made by Malays were sold at the Batu Gajah fair.

Demonstrations.

On August 31st a demonstration was given at the Cheras Agricultural Station in Selangor to 46 Malay headmen from the Klang and Kuala Langat Districts. Special attention was paid to the method adopted for opening up hilly land with a view to preventing soil wash. The interest evinced in manuring and the different varieties of cover crops was encouraging, especially at a time when a number of vegetable gardens are being formed on old rubber land.

DEPARTMENTAL NOTES.

The Director of Agriculture visits Labuan and Brunel.

Dr. H. A. Tempany, Director of Agriculture, S.S. and F.M.S., visited Labuan and Brunei between August 12th. and 30th., 1932.

The tour was made with the object of reviewing the condition of agriculture in these places and advising the Governments concerned on the development of agricultural services in these two administrative units.

Clove Trade Mission.

A Clove Trade Mission from Zanzibar, consisting of two members, Mr. G. D. Kirsopp, Comptroller of Customs, Zanzibar and Mr. C. A. Bartlett, visited Penang on August 18th. and 19th. and the Government Experimental Plantation, Serdang on August 21st. In Penang, the members of the Mission inspected a few clove plantations under the guidance of the Agricultural Field Officer, Province Wellesley and Penang and were introduced to the leading importers and exporters of cloves.

School of Agriculture, Malaya.

The School term ended on 13th. August. Next term begins on 13th. September.

A three week's special course of training for Assistant Penghulus commenced at the School on 15th. August. Sixteen Penghulus, representing all States of the Federation, are taking the course.

Parties of Penghulus from Kedah, Krian and other centres visited the School on 31st. July and 1st. August. Amongst other visitors to the School were the Hon'ble Mr. A. S. Haynes, British Adviser, Kelantan on 19th. August, and the Hon'ble Dr. N. L. Clarke of Malacca on 1st. August.

Leave.

Mr. R. A. Altson, Assistant Mycologist, has been granted 8 months and 17 days leave on full pay from 17th. August, 1932.

Statistical.

MARKET PRICES.

August 1932.

Rubber.—The price of rubber has gradually improved during the month, in Singapore from 6 cents at the beginning of the month to 9½ cents at the end of the month, the latter being the highest price recorded since early in January. The average Singapore spot price of rubber smoked sheet equal to London Standard in August was 7.41 cents per lb. as compared with 5.39 cents in July. The average London quotation was 2.44d. per lb., and New York 3.56 gold cents per lb. as compared with 1.77d. and 2.30 cents respectively in July.

Palm Oil.—The following cabled quotations per ton are c.i.f. Liverpool on a basis of 18 per cent. f.f.a. August 4th. £15.15.0, 11th. £16.5.0, 18th. £17.5.0, 25th. £17.10.0. The market has for the most part been steady and closed the month quiet.

Copra.—The Singapore market has continued steady during the month, while a good volume of business continues to be done. Average Singapore prices per picul during August were:—Sundried \$5.55, Mixed \$5.04, as compared with \$5.40 and \$4.96 respectively in July.

Coffee.—Singapore prices have improved during the month: Palembang coffee averaging \$17.25 per picul, as compared with an average price of \$16.15 in July; and Sourabaya coffee averaging from \$22.37 to \$24.01 per picul—the price within these limits depending upon quality. The average price of Sourabaya coffee in July was \$20.06 to \$23.05 per picul.

Arccanuts.—Palembangs were steady around \$3 per picul, the average price in Singapore during August being \$3.02 per picul. Bila Whole was steady at \$3.25 as compared with \$3.35 in July. Average Singapore prices per picul for other grades in August were:—Split, \$5.00 to \$7.40; Red Whole, \$6.19 to \$7.25; Sliced, \$9.50 to \$11.25; Kelantan Splits, \$7.20 to \$7.65.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during July 1932:—Siam No. 2 ordinary \$3.96; Rangoon No. 1, \$3.73, as compared with \$3.89 and \$3.88 respectively in June.

The average retail market prices in cents per gantang of No. 2 Siam rice in July were:—Singapore 28, Penang 33, Malacca 28, as compared with 29, 36 and 27 respectively in June.

Gambier.—Block gambier was quoted throughout the month in Singapore at \$6 per picul. Cube No. 1 dropped 50 cents to \$11.50, the average price for August being \$11.62 per picul. Average prices in July were \$6.31 and \$12.50 respectively.

Pineapples.—Singapore prices have been somewhat easier. At the end of the month a certain amount of buying was done for Canada. Average Singapore prices per case during August were:—1½ lb. cubes, \$3.06, 1½ lb. sliced flat \$3.32, 1½ lb. sliced tall \$3.42, as compared with \$3.07, \$3.32 and \$3.41 respectively in July.

Tapioca.—Market quiet. Average Singapore quotations per picul in August were :—Flake, fair \$3.15; Pearl, seed \$3.87; Pearl, medium \$4.00, corresponding prices in July being \$3.20, \$3.85, and \$4.

Sago.—Prices advanced early in the month owing to steady demand from European and Eastern markets, which slacked off towards the end of the month. Average Singapore prices per picul in August were :—Pearl, small fair \$4.25, this also being the average price in the previous month, and Flour, Sarawak, fair \$2.05 as compared with \$1.97 in July.

Mace and Nutmegs.—Stocks are slight, and prices steady, but the demand generally has been slow. The average Singapore prices per picul for mace in August were :—Siouw \$48.25, Amboina \$34.75, as compared with \$53.25 and \$34.75 in July.

Nutmegs 110 per lb. averaged \$22.50 per picul, and 80 per lb. \$29.50 per picul, as compared with \$23.50 and \$31.25 respectively in July.

Pepper.—Prices of white pepper improved over those ruling at the end of July, but there was little interest in Singapore Black, until the end of the month when the price of this grade improved slightly in sympathy with that of white. Average Singapore prices per picul in August were :—Singapore Black, \$18.06, Singapore White, \$24.19, Muntok White, \$24.65, as compared with \$18.44, \$24.31 and \$24.87 respectively in July.

Cloves.—Singapore stocks are light and prices have been steady. The average price of Zanzibar was \$40.25 and of Amboina \$42.25 per picul, as compared with nominal prices of \$43 and \$45 respectively in July.

The above prices are based on London and Singapore quotations for rubber and on the Singapore Chamber of Commerce Weekly Reports published in August. Palm oil reports are kindly supplied by Messrs. Cumberbatch and Co., Ltd., Kuala Lumpur, and reports on the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57 Charing Cross, London, S.W.1.

ERRATUM: *Malayan Agricultural Journal*, Vol. XX, No. 8, August 1932 page 435 line 4 up: *Pineapples* "1½ lb. sliced tall \$3.06" should read "1½ lb. sliced tall \$3.41".

GENERAL RICE SUMMARY*

July, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during July, 1932, amounted to 50,008 tons as compared with 60,331 tons in July, 1931, of which 54.2 per cent. were consigned to Singapore, 18.5 per cent. to Penang, 5.6 per cent. to Malacca, 15.2 per cent. to the Federated Malay States, and 6.5 per cent. to the Unfederated Malay States.

Of these imports 61.0 per cent. were from Siam, 37.1 per cent. from Burma, 0.7 per cent. from French Indo-China and 1.2 per cent. from Other Countries.

Total foreign exports of rice in July, 1932, were 13,924 tons (including 174 tons domestic production, exported from Penang) as compared with 14,345 tons in July, 1931. Of these exports 87.2 per cent. went to Netherlands India and 12.8 per cent. to Other Countries.

Net imports for the period January to July, 1932, were 235,566 tons as compared with 308,196 tons for the same period of 1931, a fall of 23.6 per cent.

The padi reports indicate that work for the season 1932—33 is in hand in all areas.

India.—Total foreign exports of Rice (*Indian Trade Journal* 4.8.32) during June, 1932, were 182,000 tons as compared with 239,000 tons in May, 1932, and 198,000 tons in June, 1931, decreases of 23.8 per cent. in respect of the previous month and 8.1 per cent. in respect of the same period of the previous year.

Total exports during the period January to June, 1932, were 1,418,000 tons as compared with 1,246,000 tons, for the corresponding period of 1931, an increase of 172,000 tons or 13.8 per cent.

Total exports of rice and bran from Burma for the period January 1 to July 2, 1932, amounted to 1,964,347 tons as compared with 2,237,337 tons for the corresponding period of 1931 or a decrease of 12.2 per cent. Of these exports 505,448 tons went to India in 1932 as compared with 939,440 tons in 1931, a decrease of 46.2 per cent.

Japan.—The *Trans-Pacific Journal* dated July 21, 1932, states that according to the Ministry of Agriculture and Forestry, stocks of rice in Japan (Proper) on July 1 amounted to 3,337,360 tons being 329,130 tons or 9 per cent. less than the figure for the same period of last year.

A review of the position from July 1 to the end of October 1932 shows that there is an anticipated balance of rice on November 1 (the beginning of the new season) of 759,510 tons. This includes probable imports from Korea and Formosa.

* Abridged from the Rice Summary for July 1932, compiled by the Department of Statistics, S.S. and F.M.S.

Formosa.—An official communication from H.B.M. Consul, Tamsui, dated July 2, 1932, states that the area under rice during the first crop of 1932 was 699,998 acres or 22,554 acres more than the corresponding crop last year. The estimated production is 562,060 tons being 53,182 tons or 10.5 per cent. more than the corresponding crop of 1931.

Korea.—The *International Crop Report, Rome*, for July 1932, states that the 1931—32 crop is estimated at 4,105,000 acres and 2,825,200 tons of rice as compared with 3,970,000 acres and 3,426,170 tons in 1930—31, an increase of 3.4 per cent. in acreage and a decrease of 17.5 per cent. in production.

Siam.—Exports (approximate) of rice from Bangkok during June, 1932, amounted to 130,564 tons as compared with 87,741 tons in June, 1931, or an increase of 48.8 per cent.

Exports of rice from Bangkok during the period December 1931, to June 1932, (the figures for June 1932 being preliminary) amounted to 879,63 tons an increase of 141,522 tons or 19.4 per cent. as compared with the same period of 1930—31.

Netherlands India.—*Java and Madura*. The *Korte Berichten* of July 29, 1932, states that at the end of June, 1932, the area harvested amounted to 6,949,250 acres, an increase of 220,500 acres or 3.3 per cent. as compared with the same period of 1931, the area damaged to 272,345 acres a decrease of 88,158 acres or 24.5 per cent. as compared with 1931 and additional plantings awaiting harvest to 1,781,500 acres an increase of 89,250 acres as compared with 1931, a total of 9,003,095 acres as compared with 8,781,503 acres for the same period of 1931, an increase of 2.5 per cent.

Imports of rice into Java and Madura during January to June, 1931, totalled 95,723 tons as compared with 153,943 tons for the same period of 1931 or a fall of 37.8 per cent.

Imports of rice into Outer Provinces during January to May, 1932, totalled 105,150 tons as compared with 144,331 tons for the same period of 1931 or a fall of 27.8 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932 to July 31, 1932, amounted to 724,857 (metric) tons, an increase of 12,056 tons or 1.7 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to July 31, 1932, amounted to 734,793 (metric) tons an increase of 84,076 tons or 12.9 per cent. as compared with the same period of 1931.

The *International Crop Report, Rome*, for July, 1932, states that the total production of Indo-China for the season 1931—1932 amounted to 5,621,300 tons as compared with 5,788,300 tons for the previous season, or a fall of 2.9 per cent.

Ceylon.—Imports for 6 months to June 30, 1932, were 231,712 tons, an increase of 19,721 tons or 9.3 per cent. as compared with 1931.

Of these imports, 20.0 per cent. was from British India, 68.3 per cent. from Burma, .3 per cent. from the Straits Settlements and 11.4 per cent. from Other Countries (Cochin-China, Siam, etc.).

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe, period January 1 to July 21, 1932, 603,595 tons as compared with 741,542 tons for the same period of 1931, a decrease of 18.6 per cent. Of the 1932 shipments 60.5 per cent. was from Burma, nil from Japan, 32.3 per cent. from Saigon, 3.3 per cent. from Siam and 3.9 per cent. from Bengal, as compared with 68.3 per cent. from Burma, 1.9 per cent. from Japan, 20.1 per cent. from Saigon, 6.5 per cent. from Siam and 3.2 per cent. from Bengal in 1931.
- (b) To the Levant, period January 1 to June 21, 1932, 40,565 tons, an increase of 16,125 tons or 66.0 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to June 18, 1932, 69,909 tons, a decrease of 32,181 tons or 31.5 per cent. as compared with the same period of 1931.

MALAYAN AGRICULTURAL EXPORTS, JUNE, 1932.

Product.	Net Exports in Tons.				
	Year 1931	Jan. to June 1931	Jan. to June 1932	June 1931	June 1932
Arecanuts	19,266	11,247	13,481	3,162	2,861
Coconuts, fresh	10,468	3,803	63,787*	744	9,578*
Coconut oil	9,909	4,957	5,187	851	925
Copra	100,809	41,126	37,054	6,999	8,486
Gambier, all kinds	2,563	1,240	1,502	210	224
Palm kernels	726	282	526	16	40
Palm oil	4,574	1,825	3,176	361	425
Pineapples, canned	59,457	34,833	37,202	7,667	6,137
Rubber (production)	434,857	211,055	200,321	35,687	30,701
Sago,—flour	5,608	1,539	5,188	364	1,072
" —pearl	2,429	907	1,228	153	102
" —raw	2,904†	1,286†	2,080†	65†	619†
Tapioca,—flesh	9,742	4,997	4,521	996	595
" —flour	491†	69	163†	40†	87†
" —pearl	19,006	9,354	10,448	1,976	1,964
Tuba root	74	32	50	7	‡

* '100 in number

† Net imports.

AREA OF RUBBER OUT OF TAPPING IN NETHERLANDS INDIA.

	A Totally Ceased		B Partly Ceased		Total A & B.	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
JANUARY						
Java and Madoera ...	165	75,928	63	18,372	228	94,300
Outer Provinces ...	148	47,461	70	26,567	218	74,028
Netherlands India	313	123,389	133	44,939	446	168,328
FEBRUARY						
Java and Madoera ...	110	38,393	52	12,409	162	50,802
Outer Provinces ...	102	30,999	69	30,739	171	61,738
Government ...	—	—	—	2,416	—	2,416
Netherlands India	212	69,392	121	45,564	333	114,956
MARCH						
Java and Madoera ...	123	43,586	60	13,768	183	57,354
Outer Provinces ...	133	38,045	70	26,093	203	64,138
Netherlands India	256	81,631	130	39,861	386	121,492
APRIL						
Java and Madoera ...	165	75,928	63	18,372	228	94,300
Outer Provinces ...	148	47,461	70	26,567	218	74,028
Netherlands India	313	123,389	133	44,939	446	168,328
MAY						
Java and Madoera ...	198	109,984	59	19,431	257	129,415
Outer Provinces ...	185	64,459	72	28,319	257	92,778
Netherlands India	383	174,443	131	47,750	514	222,193
JUNE						
Java and Madoera ...	219	126,363	51	17,109	270	143,472
Outer Provinces ...	200	83,849	64	28,474	264	112,323
Netherlands India	419	210,212	115	45,583	534	255,795

Total area for January amounts to 10% of the total tappable area as at the end of Dec. 1931.

- do -	February	- do -	12%	- do -	- do -
- do -	March	- do -	13%	- do -	- do -
- do -	April	- do -	18%	- do -	- do -
- do -	May	- do -	24%	- do -	- do -
- do -	June	- do -	27%	- do -	- do -

Abstracted from *Korte Berichten*.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT END OF JULY, 1932.**

STATE OR TERRITORY	ACREAGE OF TAPPABLE RUBBER end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—	(1)	(2)				(7)	(8)
Perak	...	238,420	7.9	30,054	12.6	48,910	20.5
Selangor	...	294,030	8.3	36,499	12.4	60,829	20.7
Negri Sembilan	...	217,002	10.1	23,173	10.7	45,138	20.8
Pahang	...	35,122	21.5	4,778	13.6	12,325	35.1
Total F.M.S.	...	784,574	9.3	94,504	12.0	167,202	21.3
STRAITS SETTLEMENTS :—							
Province Wellesley	...	44,055	8.2	8,132	18.5	11,737	26.6
Dindings	...	6,700	13.2	1,027	15.3	1,911	28.5
Malacca	...	110,288	5.5	22,893	20.8	28,996	26.3
Penang Island	...	1,585	66.8	84	5.3	1,142	72.1
Singapore Island	...	28,033	50.1	3,741	13.3	17,799	63.5
Total S.S.	...	190,661	13.5	35,877	18.8	61,585	32.3
UNFEDERATED MALAY STATES :—							
Johore	...	313,385	14.6	33,300	10.6	79,200	25.3
Kedah (a)	...	114,254	8.4	4,616	4.0	14,254	12.5
Kelantan	...	16,785	36.8	1,590	9.5	7,774	46.3
Trengganu (b)	...	4,300	nil	nil	nil	nil	nil
Perlis	...	903	19.6	426	47.2	603	66.8
Total U.M.S.	...	449,627	13.8	39,932	8.9	101,831	22.6
Total MALAYA	...	1,424,862	11.3	170,313	12.0	330,618	23.2

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

The above table was prepared by the Statistics Department, S.S. and F.M.S.

METEOROLOGICAL SUMMARY, MALAYA, JULY, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE																
	Means of				Absolute Extremes		PERATURE		Number of days						Total	Daily Mean	Per cent												
	A.	B.	Mean of A and B	Highest	Lowest	Highest	Lowest	At 1	At 4	Most in a day	Precipitation, .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs.				Gale force 8 or more											
																			Max.	Min.	° F	° F	° F	° F	° F	° F	in.	mm.	Amt
Relay Hill, Kuala Lumpur, Selangor	90.7	71.2	80.9	95	69	79	74	83.6	84.6	1.73	43.9	0.60	9	8	2	1	178.75	5.77	47										
Bekit Jeram, Selangor	88.1	72.4	80.3	92	69	83	74	84.4	86.6	2.72	69.1	1.00	11	8			216.90	7.00	57										
Sitiawan, Perak	90.6	72.3	81.5	94	70	87	75	84.3	85.0	1.62	41.2	0.49	9	7	1		209.85	6.77	55										
Kroh, Perak	85.6	69.2	77.4	88	65	82	72	81.9	82.6	4.33	110.0	1.24	12	10	1		170.95	5.51	45										
Temerloh, Pahang	88.7	71.7	80.2	93	69	82	74	84.9	85.3	0.87	22.1	0.16	7	7	1	14	166.55	5.37	44										
Kuala Lipis, Pahang	88.5	71.5	80.0	91	69	84	75	83.7	84.4	3.21	81.5	1.28	8	8		20	174.70	5.64	45										
Kuala Pahang, Pahang	87.1	74.1	80.6	89	72	78	77	86.2	85.7	1.32	33.5	0.48	11	4	2		212.85	6.85	56										
Mount Faber, Singapore	87.1	75.7	81.4	91	70	77	79	81.5	82.5	10.00	254.0	2.51	12	9	3	1	204.40	6.59	54										
Butterworth, Province Wellesley	87.6	74.4	81.0	89	71	85	79	84.3	85.4	5.14	130.6	1.42	13	11	1	2	187.15	6.04	49										
Bekit China, Malacca	84.6	73.5	79.1	87	70	80	70	82.1	83.6	9.52	241.8	2.13	18	16	1		176.00	5.68	47										
Kluang, Johore	87.5	71.1	79.3	91	69	76	73	81.6	82.6	5.12	130.1	1.17	14	11	3	9	173.60	5.60	46										
Bukit Lalang, Mersing, Johore	87.9	71.1	79.5	91	69	77	73	81.6	82.2	8.30	210.8	1.84	13	13	3		216.80	6.99	57										
Alor Star, Kedah	87.4	74.5	80.9	90	71	81	77	86.0	86.4	4.36	110.7	0.93	15	13	4	1	146.80	4.74	38										
Kota Bharu, Kelantan	89.0	73.5	81.3	92	72	84	76	84.5	85.3	6.10	134.9	1.30	15	13	3		174.10	5.62	45										
Kuala Trengganu, Trengganu	88.0	73.4	80.7	90	71	84	77	83.2	84.6	3.99	101.4	1.46	11	9	6	1	179.20	5.78	47										
HILL STATIONS.																													
Fraser's Hill, Pahang 4268 ft.	73.8	62.0	67.9	78	58	66	64	71.4	72.0	3.45	87.6	0.97	10	10	1	4	201.75	6.51	53										
Pahang, Highlands, Tanah Rata, Pahang 4750 ft.	72.5	55.9	64.2	76	50	69	60	70.3	70.1	3.76	95.5	0.90	15	11	2	8	155.45	5.01	40										
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.7	59.0	65.3	76	57	68	60			3.67	93.2	0.89	13	11	2	2	171.25	5.52	45										

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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THE Malayan Agricultural Journal.

OCTOBER, 1932.

EDITORIAL.

The Inter-Departmental Conference 1932.

Since the early days of rubber planting in Malaya, various authorities have drawn attention to the danger of allowing the agricultural prosperity of the country to depend almost entirely on one product. In spite of the danger foreseen by so many and especially in view of the warning note which was struck by the incidence of a rice shortage in 1920, which, as His Excellency the Governor reminded us in his recent speech at the Malayan Exhibition, cost the Government alone \$40,000,000., the country still remains vulnerable to a repetition of similar or worse conditions.

The experience of the past in the matter of food shortage was largely overlooked, because of the satisfactory profits obtained from the cultivation of the rubber tree. Instead of re-organising agriculture in Malaya, further areas of land were opened up for rubber cultivation—which may be regarded as highly justifiable development—but without the safeguard of ensuring future food supplies or the alternative crops which might assist in tiding over any depression in the chief agricultural industry.

In both Java and the Phillipines, the Governments have for many years encouraged the local production of rice and other food crops and to-day these countries are largely independent of supplies from abroad, so that although their main export industries are depressed, the condition of the peasantry is markedly better in many respects than is the case in Malaya. Incidentally, it is observable that in those districts of this Peninsula which are self-supporting in the matter of rice production the prevailing distress is considerably less acute than elsewhere.

An Inter-Departmental Conference was held in Kuala Lumpur during the first week of August, 1932, with the object of examining the present position and considering measures tending to ameliorate the lot of the *raia* in the present period of distress by encouraging the extension and improvement of certain crops and by increasing the production of the area under foodstuffs.

The question of providing suitable marketing channels for peasant produce is a matter of difficulty, especially in a country like Malaya where certain types of produce have to compete with imported articles of which the distribution has

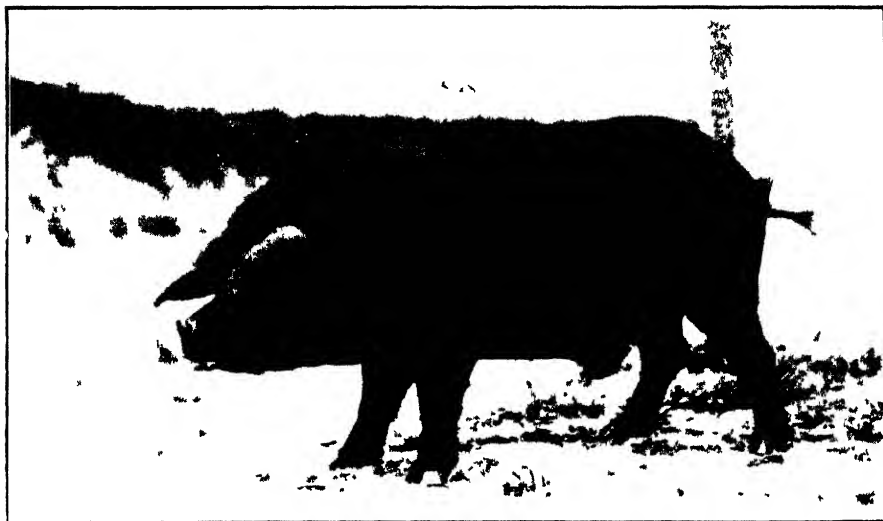
long been organised, and where, in addition, the small-holders are often exploited by rings and combines of middlemen. If progress is to be achieved the provision of better marketing facilities appears to be of vital importance. This and other economic questions were discussed at length during the Conference, in addition to matters relating to the purely agricultural side of the problems relating to the industries under consideration.

The importance at the present time of Chinese agriculture in Malaya in relation to the supply of vegetables and fruit is perhaps not fully realised, nor what the effect would be if for any reason the supply of these commodities was seriously curtailed.

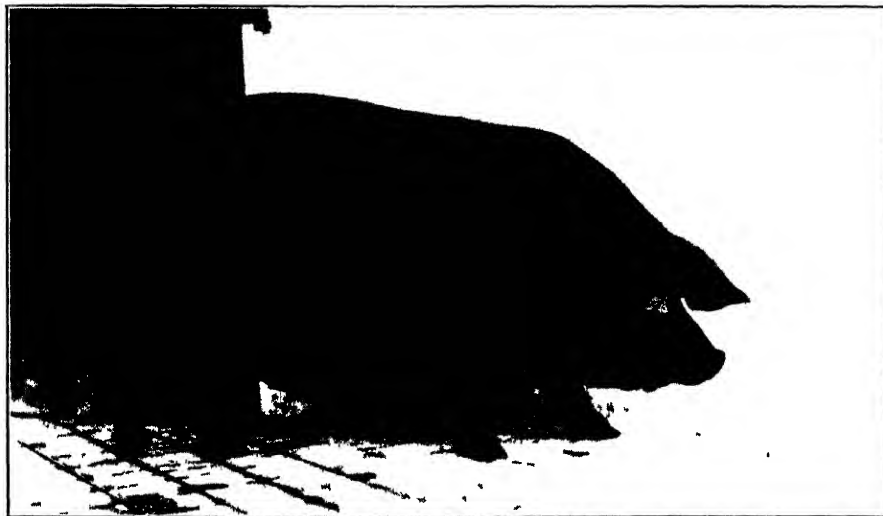
The Department of Agriculture has of recent years obtained an amount of information regarding agriculture on Chinese small holdings through the Chinese Sub-Inspectors of Agriculture, and has been able to inaugurate experimental work with a view to investigating the possibility of changing the rather objectionable manuring practise adopted by Chinese market gardeners.

This question also received attention during one session of the Conference, as well as questions relating to land alienation, pig farming, and tea growing amongst Chinese small-holders.

The Conference, an account of which appears in the present number of this journal, was fruitful of many results and has undoubtedly been a step in the right direction. It should result not only in an appreciation of the difficulties common to each branch of the executive and administrative services represented, but in closer liaison between them towards the object of improving and encouraging the wider scope of agriculture advocated.



LARGE BLACK BOAR
Nine months old



LARGE BLACK SOW
Pregnant, twelve months old

Original Articles.

THE PIG FARM AT SERDANG

BY

T. D. MARSH,

Assistant Agriculturist.

The objects of this branch of the Stock Farm are, primarily, to maintain animals of European breeds to ascertain their suitability to the conditions prevailing in Malaya.

Secondly, to multiply the animals of the suitable breeds for distribution throughout the Peninsula with a view to the improvement of local pigs by cross-breeding with the imported breeds, and thirdly, to demonstrate to breeders that an improvement in the type of the local pigs can be accomplished by crossing with animals of the European breeds

As it was proposed to inaugurate feeding experiments, in the first instance rations were arranged to test the suitability of foods not commonly used in Malaya, and to educate the local breeders on the necessity of feeding minerals.

Owing to the limited and temporary accommodation of the piggery, and insufficiency of funds, it has not been possible to conduct close research on feeding, and the results obtained, therefore, have mostly been based on observations

The pig farm was commenced in a small way at the beginning of 1929 by the importation of the following pigs from Hong Kong—two Large Black boars, two Large Black sows, two Middle White boars, and two Middle White sows.

These pigs were about nine months old when received. The cost was \$75 each, free on board, Hong Kong. The addition of shipping charges, insurance, crates and agency fees increased the figure to \$87 per head.

Four typical Chinese gilts of two distinct types were purchased for breeding experiments at a cost of \$21 per head.

A temporary shed 60 ft. x 30 ft. to house these animals was built of round jungle timber with an attap roof, having open sides and ends, and with a central passage running lengthwise. The building contained twelve styes, four of which were larger than the others for farrowing pens. The floor was gravel with a fairly steep slope. Partition walls were of round jungle timber placed adjoining each other vertically, and about four feet high. The cost of the building was \$270.

Feeding Troughs.

Arrangements were made with an earthenware pipe manufacturer to supply half-section glazed pipes in two feet lengths and in two sizes, 8 inches and 12 inches in diameter, without socketed ends. These pipes were moulded into blocks of cement concrete, so that they formed the lining of the troughs.

The troughs were hygienic, cheap, and fairly heavy. They were constructed

with a drain hole at one end and fitted with a wooden plug to facilitate cleaning operations. The advantage of the glazed linings over ordinary concrete is that the latter is porous and liable to become sour.

A temporary bathing tank was built of cement concrete in a water course near the piggery. It was about 5 feet wide and 15 feet long, consisting of side walls with a ramp leading to the bath. The height of the water is controlled by inserting a lesser or greater number of hardwood planks in vertical grooves in the side walls and across the outlet. The cost of this tank, including labour and materials, was about \$20.

Recently, an up-to-date piggery has been constructed 64 feet long and 28 feet wide with a framework of hardwood posts, asbestos cement sheets being used as a roofing material. This building contains 12 pens, 10 ft. x 7 ft 6 ins. and two larger pens for brood sows of 10 ft. x 15 ft.

Outside walls to a height of 5 feet and all internal partition walls are constructed of one course of bricks with a cement concrete rendering on all sides.

From the top of the outside walls to the eaves which are $7\frac{1}{2}$ feet high is expanded metal.

There is a door leading from each styre to an outside yard.

All the pens adjoin a central passage running from end to end of the building. The floor of the sleeping portion of each pen is raised about two inches higher than the general level of the styre floor, the floors are crossed with grooves about one half inch deep, at intervals of about 6 inches, to prevent the animals from slipping, and a fall of 1 in 100 is allowed with the slope towards a drain constructed along each side of the central passage.

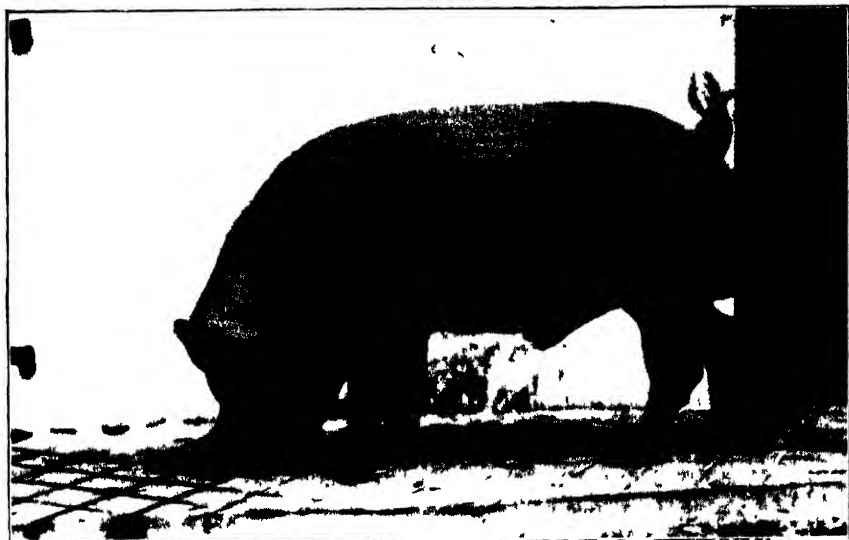
The feeding troughs are arranged along each side of the central passage, and are constructed of iron. They have a vertical swing shutter hinged along the top horizontal edge, which, when required, will shut the pigs away from the trough whilst it is being cleaned, or food is being supplied.

The drainage system of the pens ordinarily conducts the urine into a tank outside the building, a bye-pass being constructed to allow water used in washing the pens to flow into the rain-water drains.

The cost of this piggery was \$1,500, to which must be added the cost of the 14 iron doors and troughs which were imported from England, at a landed cost of \$1,220.

This piggery has been erected as a model type, with a view to the hygienic principles involved. Temporary styres, having cracks and crevices throughout, harbour both internal and external parasites. The styres are built mainly of concrete and iron and offer no shelter for parasites in any stage of their life history. They have been constructed to maintain a high degree of cleanliness and will give a greater control of the animals and facilitate the inauguration of feeding trials.

The experience gained at Serdang shows that pigs of the Middle White and Large Black breeds are suited to tropical conditions provided they are not unduly exposed to the sun and they are protected from the attacks of disease



MIDDLE WHITE BOAR



MIDDLE WHITE SOW.

and parasites. Two of the original importations from Hong Kong succumbed to liver and lung worms. It might be preferable to import pigs from a temperate climate as they would be less liable to be infected with the parasites or diseases that chiefly flourish in the tropics; on the other hand, they may be more susceptible to tropical diseases and parasites.

Conversely, pigs that have been acclimatised to the tropics or sub-tropics for a few generations and have been kept under hygienic conditions and maintained in a healthy state, would be less liable to suffer from the effects of the heat if transferred from one tropical country to another. Furthermore, such animals might have developed a certain immunity to tropical diseases.

The experience gained to date is insufficient to prove whether pigs of European breeds that are maintained pure for a few generations lose any vigour through their stay in the tropics. As pigs breed and mature very quickly it is imperative that new strains be introduced periodically to prevent inbreeding, this necessary practice also maintaining the vigour of the herd.

With healthy vigorous stock, a limited amount of inbreeding is permissible. Care should, however, be taken to select robust animals and the practice must not be carried too far. There has been a greater demand for pigs of the Middle White breed than those of the Large Black, and new importations of stud stock of the former breed are now being made to prevent inbreeding of the present stock.

With regard to the Large Black breed, the farm was fortunate in being presented with two pedigree Large Black boars by Mr. W. F. Zehnder of Malacca. The progeny of these boars is an improvement in type in comparison with those sired by the original imported boars.

Since the commencement of the Pig Farm the number of pigs sold for breeding purposes, exclusive of those slaughtered for pork, is 75. This number includes selected cross-bred animals out of Chinese sows and sired by boars of the Middle White and Large Black breeds.

The table hereunder gives the distribution of the pigs to the various States in Malaya :—

Table Showing the Distribution of Breeding Stock from the
Government Stock Farm, Serdang, between
August, 1929 to August, 1932.

STATES.		Middle White.	Large Black.	Cross-bred.
Perak	...	5	3	4
Selangor	...	14	3	5
Negri Sembilan	...	2	—	—
Pahang	...	1	3	13
Penang and Province				
Wellesley	...	2	2	8
Singapore	...	—	1	3
Johore	...	4	2	0
Totals	...	28	14	33

Owing to the limited accommodation available, breeding experiments with Chinese sows and boars of European breeds have only been carried to the first generation. The type of cross-bred produced is far superior to the mature local sows. These animals have a straight top line, they stand erect on their fetlocks, and the pigs of each cross mature much earlier than the local pigs; they are notably uniform in type and they take most of their characteristics from the sire, even to colour. It is anticipated that the quarter-bred pigs would result in a further improvement in type and conformation; there would be very little reversion in individuals to the Chinese type owing to the prepotency of the sire.

Should cross-bred boars be mated to cross-bred sows there is little doubt that the resultant progeny would vary considerably in type and colour.

Minerals.

The excellent type of pigs produced in the first crosses may not be all attributable to the influence of the sire, it is necessary to mention that the animals are fed on balanced rations with the addition of ample mineral salts. It is considered that most of the live stock reared in Malaya suffer from a deficiency of minerals in their food.

Feeding.

Some rations that are fed at Serdang are given hereunder, from which other balanced mixtures may be prepared according to the prices and their availability in the market. Grass should be given freely, but the appropriate allowance required is given below:—

(a) Young Pigs up to 4 months old.

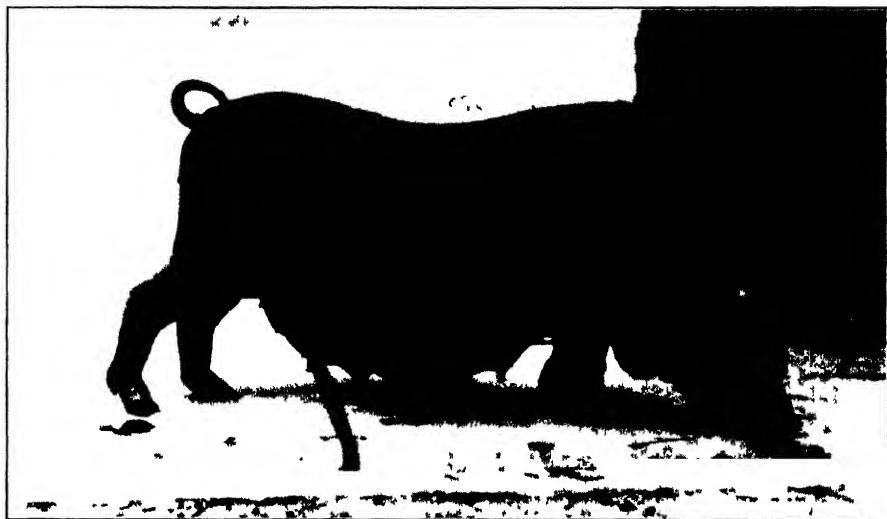
Vegetables or young grass per head	...	5	lbs.
Rice bran	...	20	"
Coconut cake	...	2	"
Soya bran cake	...	10	"
Crushed gram	...	5	"
Minerals	...	$\frac{1}{2}$	lb.

This mixture should be fed at the rate of $4\frac{1}{2}$ to 5 lbs. per picul of live weight per day.

(b) Growing or Fattening Pigs from 4 to 6 months old.

Vegetables or young grass	...	10	lbs.
Rice bran or Maize	...	18	"
Coconut cake	...	4	"
Soya bean cake	...	4	"
Crushed gram or gingelly cake	...	4	"
Minerals	...	$\frac{1}{2}$	lb.

Allow about 4 to 5 lbs. of the mixture per picul of live weight per day.



TYPICAL CHINESE SOW OF THE PIEBALD TYPE.

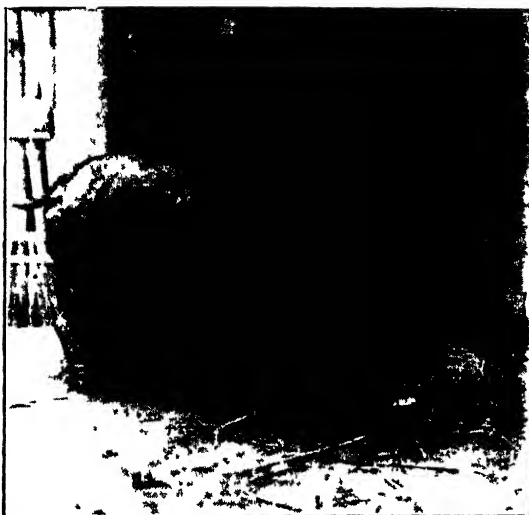


TWO TYPICAL CROSS-BRED GILTS.

Out of Chinese Piebald Sows:

Left --- Sired by Middle White Boar:

Right: - Sired by Large Black Boar.



TYPICAL CHINESE SOW OF THE ALL BLACK TYPE



NEW PIGGY AT THE STOCK FARM, SERDANG



INTERIOR OF PIGGY
Showing feeding troughs

MATURE PIGS.

Vegetables or grass	... 10—15 lbs.
Rice bran	... 18 "
Soya bean cake	... 4 "
Coconut cake	... 3 "
Crushed gram or gingelly cake	... 3 "
Minerals	... $\frac{1}{2}$ lb.

Allow 1—2 lbs. of the mixtures per picul of live weight per day.

Some Diseases that have occurred at Serdang.

The pigs at the Government Experimental Plantation, Serdang, have suffered from mild attacks of worms on a few occasions.

The first case that occurred was an imported Middle White sow which developed a cough; her litter was infected by the same parasite. This was diagnosed on the post mortem of a weaner as being due to the attacks of the lung worm, *Strongylus paradoxus*, which caused the death of the sow and all her litter. The Government Veterinary Surgeon treated the pigs but without success. Since that time no more pigs have been affected.

As practically all pigs suffer from the effects of intestinal worms, periodic administration of Santonin is given, the drug being administered in doses of 5 to 20 grains according to the size of the animal, followed about half a day later with a mild dose of Epsom salts of $\frac{1}{2}$ to $1\frac{1}{2}$ ozs. per pig.

Carbon tetrachloride is a very effective vermifuge and may be given to pigs in gelatine capsules, after fasting the animals for twelve hours. The dose is one to six drachms according to size of animal.

It has been observed that pigs having a stiffness in the hind quarters, at times almost amounting to paralysis, have responded quickly to treatment by Santonin, indicating that intestinal or kidney worms were causing the sickness.

A case of tuberculosis in an imported stud boar was diagnosed by the Veterinary Surgeon, and the animal destroyed.

A few mild cases of diarrhoea have been noticed in litters when the pigs are between the ages of two and four weeks; this trouble is probably due to bacterial infection. Pigs seldom suffer severely and the bowels become normal after a few days. To prevent the disease, cleanliness in the sty and feeding troughs is essential and it is recommended that the navels of all pigs at birth and again a few days later be painted with tincture of iodine.

Blow flies have been troublesome on a few occasions, egg laying has been observed in the navels of young pigs a few hours after being farrowed and also in the vagina of sows immediately after farrowing.

Nettle rash or urticaria has occurred, it has usually been associated with the feeding of Indian grams and is probably due to digestive troubles. This condition is manifested by small raised lumps on the skin which appear suddenly. A reduction of the highly nitrogenous constituents of the ration with a dose of Epsom salts of 1 to 2 ozs. usually effects a cure.

THE ROTENONE CONTENT OF MALAYAN TUBA ROOT

BY

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Acting Agricultural Chemist

and

GUNN LAY TEIK,

Assistant Analyst.

Introductory.

Although for many years the fresh roots of certain species of the genus *Derris*, commonly called tuba, have been known to Malays for their toxic effect on fish and to Chinese market gardeners for their value as an insecticide, the general use of the roots in proprietary insecticidal preparations has not developed to the extent that might have been expected in view of their relatively wide local application.

This can be ascribed to various causes, among which may be mentioned the difficulty of obtaining regular supplies of roots of uniform quality, a lack of knowledge concerning the chemical composition of the toxic substances present and the variations found in insecticidal potency.

Recent work by the United States Department of Agriculture (1) (2) regarding the composition and the relative toxicities of various chemical compounds present in the roots has indicated, however, that there are considerable possibilities for tuba root as a general insecticide, provided the roots contain an appreciable proportion of a substance called rotenone, their investigations having shown that towards certain insects rotenone is by far the most potent of the various compounds as yet isolated from the roots.

As a result of the increased interest taken in the commodity, analyses have been made of roots collected from different parts of the country in order to ascertain the extent of the variations in the rotenone contents of consignments of material at present being offered for sale.

In the present paper, therefore, it is proposed first of all to consider the reasons for the lack of development of the industry and then to record the results of the investigation regarding the variations in the rotenone contents from the point of view both of commercial consignments of roots and of samples from different species of *Derris*. In this connection it may be mentioned that an investigation has already been commenced to ascertain the species of *Derris* which will yield the highest proportion of rotenone, the conditions under which the plants must be cultivated and the age at which the roots should be harvested.

The question of the preparation from the roots of an extract for export, thereby saving the heavy charges incidental on the shipment of a product of such a bulky nature as dried roots, will also be mentioned.

Variation in Quality of Root.

As regards the question of variation in quality there is little doubt that the chief causes are the number of different species of *Derris* to be found and the comparative absence of any systematic cultivation resulting in supplies of mixed roots, both of species and age. Further, from the point of view of the commodity itself, the lack of any marked features by which roots of different species can be distinguished and the absence of any chemical standard for comparison must not be overlooked. In this connection, it is well-known that certain manufacturers of insecticides, realising the difficulty of purchasing in the open market sufficient quantities of roots of uniform quality, made special arrangements to ensure their own supplies of a particular species, thus being able to maintain a standardised product.

As stated above, there are several species of the genus *Derris*, for example in a digest of literature (3) published by the United States Department of Agriculture on the subject it is stated that there are no fewer than 40 species and it is not unlikely, therefore, that these will show considerable variations as regards toxic properties. Also, since the use of tuba root as a fish poison has been known to Malays for generations and little systematic cultivation has been carried out with the crop, it is reasonable to suppose that with the large number of species extant consignments of tuba root collected from different sources will probably consist of a mixture of roots. Some of the roots possibly may not even belong to the genus *Derris*, since it is well-known that roots of other plants of similar habits possess similar toxic properties. Further, it has been established that the toxic properties can be correlated both with the age and the size of the root.

While an examination of a mature *Derris* plant should reveal its botanical classification there is no easy means of identifying the species from the dried roots so that, unless the latter can be subjected to analysis, a buyer will always be running a grave risk as regards quality in purchasing roots of unknown origin.

In connection with the question of a chemical standard it may be mentioned that about 9 years ago, following an investigation carried out at the Rothamstead Experimental Station (4) a suggestion was made to value the root on the amount of matter extracted with ether, the genuineness of the extract being confirmed by the determination of its methoxyl content. As far as is known the proposal was never generally accepted, although the amount of ether extract has been used as a standard for comparative purposes in this Department (5) (6) and there is reason to believe that buyers of tuba root have used and do still use the amount of matter extracted by certain solvents as a criterion of the value of the root for insecticidal purposes

Toxic Substances Present in Roots.

Although, as pointed out by Roark (1), a Japanese chemist, Nagai, as far back as 1902, isolated from the roots of *Derris chinensis* a definite chemical

compound having toxic properties, which was called rotenone, it was not until recent years that any appreciable progress was made as regards the chemical constitution of either rotenone or the other chemical compounds to which roots of the genus *Derris* owe their toxicity. Among these latter may be mentioned deguelin, tephrosin and toxicarol, all of which have been isolated and described by Clark (7) (8).

Further, as regards rotenone it may be mentioned here that as a result of recent work carried out by the United States Department of Agriculture, LaForge and Haller have now assigned a constitutional formula to this compound (9). While it is true that such a step may be regarded as a preliminary to the synthesis of rotenone, the effect of which might be to alter profoundly the chances of the natural product competing successfully with the synthetic, a consideration of the structural formula reveals the fact that synthesis would undoubtedly involve some complex chemical processes, which would materially increase the cost of production.

At this stage, therefore, it may be of interest to record briefly the names, chemical formulae and appearances of the four chemical compounds now known to be present in roots of various *Derris* species.

Name of Compound	Chemical Formula	Melting Point	Appearance
Rotenone	$C_{23}H_{22}O_6$	163°C.	White crystals
Deguelin	$C_{23}H_{22}O_6$	171°C.	Pale green crystals.
Tephrosin	$C_{23}H_{22}O_7$	198°C.	White crystals.
Toxicarol	$C_{23}H_{22}O_7$	219°C.	Yellow crystals.

It will be seen, therefore, that all four compounds are closely related, rotenone and deguelin being isomeric, also tephrosin and toxicarol. Further, the last two compounds only differ from the former by the presence of an additional atom of oxygen.

The relative values of these substances as contact insecticides have been studied by Davidson (10) who found, for example, that towards the bean aphid, *Aphis rumicis*, aqueous suspensions of these four chemical compounds stood in the following ratio :—

Rotenone	Deguelin	Tephrosin	Toxicarol
400	40	10	1

Davidson concluded therefore that the gradation in toxicity of these four chemical compounds formed the clue to the variations in insecticidal potency previously observed in *Derris* root. Further, the results indicated that the rotenone content appeared to be the most satisfactory criterion for measuring the value of a sample of root since, unless occurring in exceptionally large amounts, the other three constituents could not affect substantially the insecticidal potency of the extract.

As a consequence, a proposal has been put forward in the United States of America to grade *Derris* root according to its rotenone content and this is

therefore the aspect from which the results given in this paper must be regarded. The variations in rotenone content are, however, not to be taken as an indication of the relative toxicities of the different species which can only be determined by controlled insecticidal tests.

Method of Analysis.

Before giving the results of the investigation regarding the variations in the rotenone content it is considered advisable to refer briefly to the method of analysis, which is based on that originally described by Roark (1).

The method for the extraction of rotenone depends on its relatively low solubility in ether, 0.4 grammes per 100 c.c. of solution at 20°C., so that separation of the compound from an ethereal solution can be readily effected, especially if the solution is cooled.

It will be realised, however, that since compounds other than rotenone are also extracted by ether and may therefore tend to separate with the rotenone, the method can only be regarded as approximate, although it must be admitted that in the majority of instances the purity of the crude product, judged by its crystalline structure and melting point, is comparatively high. In this connection it may be mentioned that the proportion of the crude rotenone to that of the total ether extract may vary from nil to 33 per cent. This variation in proportion will be referred to later.

It has been found necessary to amend the original method as described by Roark in order to suit local conditions, the modified method being as follows:—

One hundred grammes of the finely ground root are dried in a water-jacketed vacuum drying oven at a temperature of approximately 75°C for 8 hours and completely extracted in a Soxhlet apparatus with ether. The combined extracts are concentrated to a volume of approximately 40 c.c. The flask containing the extract is closed with a cork and placed in the cold cabinet. Either crystallisation proceeds rapidly or the liquid becomes thick and viscous. In the latter case the flask is removed and allowed to stand in the air until the liquid is just mobile again, when it is seeded with a small amount of pure rotenone, approximately 0.05 gramme, and the flask replaced in the cold cabinet. In this way it is possible to effect fairly rapid crystallisation.

The flask is allowed to remain overnight in the cold cabinet, the next morning the crude rotenone is filtered on a tared Gooch crucible, using a paper disc as filter, washed three times with ice-cold ether, 5 c.c. at a time, dried at 100°C. for one hour and weighed.

The method of direct seeding is found to be especially useful in those cases in which the proportion of rotenone is low, for example 2 per cent. and less, and is in our opinion preferable to depending upon a slow rate of deposition of crystals from a viscous solution, the crude rotenone under such conditions being often somewhat impure.

As explained previously, a control determination of the total amount of ether extract is also made, using for this purpose a separate portion, 5 grammes,

of the finely ground root. In this connection it may be mentioned that this figure can also be evaluated by adding to the percentage of rotenone that of the residual amount of ether extract. The latter can be determined by making up the filtrate from the rotenone precipitate to a definite volume, evaporating an aliquot portion to dryness and weighing the residue.

With regard to the general question of the method of estimation of rotenone a proposal has been put forward by the United States Department of Agriculture (11) to substitute carbon tetrachloride for ether on the grounds that the rotenone separates more easily as a complex from the carbon tetrachloride solution and in a greater state of purity than from the corresponding ether extract, more reliable results being obtained. Further, it is stated that samples of roots from which no rotenone could be separated, using ether, even when the extract was seeded, gave carbon tetrachloride extracts from which rotenone separated readily, as much as 2 per cent. being obtained in the case of one sample.

The method has been tried but without the same degree of success, results of greater accuracy having been obtained with ether than with carbon tetrachloride. Since, however, the question is still under correspondence a final decision as regards the adoption of a definite solvent for assaying roots must therefore be delayed.

Results of Analysis.

The figures in the following table, which give the results of analysis of samples of roots taken recently from consignments offered for sale, will afford some indication of the wide variations as regards both the amounts of crude rotenone and of total ether extract. In order to make the table as concise as possible the figures have all been calculated on a moisture-free basis.

Sample No.	Crude Rotenone per cent.	Ether Extract per cent.
1	5.9	24.0
2	7.7	22.8
3	1.0	22.3
4	4.7	22.6
5	Nil	2.3

Based on the proposed method of valuation by rotenone content the results clearly indicate the necessity for assaying individual consignments of roots on account of the wide variations. In this connection it may be mentioned that, taking the series as a whole, the figures, calculated on a moisture-free basis, have varied in the case of the rotenone from nil to 8.1 per cent., the total ether extract from 2.3 to 29.1 per cent. It must be distinctly understood that there is no relationship between the crude rotenone as determined by the method referred to above and the total amount of ether extract. This question will be referred to later.

Examination of Different Species of *Derris* for Rotenone Content.

Apart from the variations in rotenone content the results of analysis indicated the probability of a species of *Derris* in which a high ether extract was combined with a relatively high rotenone content.

Before detailing the further steps taken as regarding ascertaining the particular species it seems advisable to recall the results of the previous work carried out at the Experimental Plantation, Serdang. The object of this investigation was an endeavour to correlate the age of harvesting with the toxicity, as judged by the amount of ether extract (5) (6), two species of *Derris*, *D. elliptica*, tuba puteh, and *D. malaccensis*, erect Sarawak, being examined. The results, which are summarised below, showed that the amount of ether extract was much higher for the roots of *D. malaccensis*, erect Sarawak, than for *D. elliptica*, tuba puteh. In addition, the results indicated that the optimum age of harvesting, as judged by the amount of ether extract, was approximately 23 months from the time of striking the cuttings, also that the amount of ether extract was greater in the case of the fine roots than the coarse roots.

Species of <i>Derris</i>	Optimum Age of Harvesting	Ether Extract (moisture-free basis)	
		Coarse roots	Fine roots
	months.	per cent.	per cent.
<i>D. elliptica</i> , tuba puteh	23	4.5	9.6
<i>D. malaccensis</i> , erect Sarawak	23	32.2	34.2

At the time of the investigation referred to previously, there were no plants of sufficient development to warrant harvesting, opportunity was therefore taken to analyse roots of six different species of *Derris* being grown on a small scale at the Experimental Plantation, Kuala Lumpur for the purpose of maintaining stocks of planting material. The plants were approximately 3 years old so that, judged by the previous results at Serdang, the roots were past the optimum age of harvesting.

The results of analysis, calculated on a moisture-free basis, are shown in the table on the next page.

From the point of view of rotenone content the results of analysis indicate that *D. elliptica*, tuba puteh, is the only species likely to meet the requirements of the American market, the rotenone content of *D. polyantha*, although appreciable, being apparently of a much lower order.

It is interesting to note that while the roots of *D. malaccensis*, erect Sarawak, have a high figure for ether extract, they are lacking in rotenone.

The results serve to show the wide differences existing as regards both rotenone content and ether extract in species which differ only in their habit of growth, that is whether creeping or erect, and point therefore to the necessity of taking the greatest care as regards the selection of planting material in order to ensure the maximum yield of product,

Variety of Derris	Nature of Roots	Crude Rotenone	Total Ether Extract	Proportion of Crude Rotenone to Total Ether Extract
		per cent.	per cent.	per cent.
<i>D. elliptica</i> , tuba puteh	Coarse	6.5	22.6	28.8
	Fine	6.8	24.8	27.4
<i>D. elliptica</i> , creeping Sarawak ...	Coarse	No coarse roots.		—
	Fine	Trace	4.0	
<i>D. malaccensis</i> , tuba merah ...	Coarse	0.7	14.5	4.8
	Fine	0.1	19.8	0.5
<i>D. malaccensis</i> , erect Sarawak ...	Coarse	0.1	24.2	1.7
	Fine	0.8	27.3	2.9
<i>D. polyantha</i> ...	Coarse	2.7	12.6	21.4
	Fine	3.6	14.4	25.0
<i>Derris</i> (species not yet identified) ...	Coarse	Nil	2.3	—
	Fine	Nil	3.0	—

The figures also confirm the previous statement as regards the absence of a general relationship between the amount of ether extract and rotenone, although they do point to a definite relationship in this connection as regards species containing appreciable amounts of that compound.

In this connection it may be mentioned that although in the case of both varieties of *D. malaccensis* small amounts of rotenone are recorded, the figures cannot be relied upon with any particular degree of accuracy, the crude rotenone in all cases being comparatively impure.

Comparing these results with those previously obtained at Serdang it will be noticed that while the figures for the ether extract of *D. malaccensis*, erect Sarawak, are of the same order, those for *D. elliptica*, tuba puteh, show considerable variation. Apart from the possibility of planting material having been mixed, which seems far too remote, it is difficult to account for the difference, which it is thought can only be due to either poor soil conditions, lack of some particular plant nutrient or unsuitable environment. These points are being investigated. Against these possibilities it must be borne in mind, however, that an average yield of air-dry root, approximately 1,100 lbs. per acre, was obtained at the optimum age of harvesting. For the present therefore, the results of the original experiments with this species can only be regarded as abnormal.

As regards *D. elliptica*, tuba puteh, from Kuala Lumpur it may be mentioned that both the high figure for the rotenone content and the proportion of rote-

none to total ether extract have been confirmed as a result of analyses of roots of this species taken from estates where the crop is being systematically cultivated.

Enquiries from the estates in question showed that the original source of their planting material was Geylang, Singapore, where the root is cultivated on a small scale, principally for use in market gardens. Samples of root were accordingly obtained from that source, the results of analysis again showing both a satisfactory proportion of rotenone and the normal correlation between the amount of rotenone and that of the ether extract.

In view, however, of the abnormal results obtained to date at Serdang with this species it will be realised that no guarantee can be given that, even though high grade planting material is obtained, for example from Singapore, the plants when grown elsewhere in Malaya will yield roots of a similar high rotenone content.

In this connection it may be mentioned that in order to endeavour to elucidate this point, exchanges of planting material have been effected between Kuala Lumpur and Serdang, so that in due course it is anticipated the question of the present abnormal results obtaining at Serdang will be solved. Experiments are also being laid down with the object of ascertaining the variations in the amount of rotenone content with age of root.

General Considerations on the Preparation of an Extract.

As stated previously, the dried roots are exported, the roots being baled in order to save shipping charges. With the same object in view it is understood that the dried roots are sometimes finely chopped, the product being then packed in Venesta or other light wooden chests.

Apart, however, from the form of packing adopted it will be realised that even in the case of dried roots, freight charges are being paid on a relatively large amount of non-toxic material, for example, assuming all the matter extracted by ether has a toxic value it will be seen that in the case of *Derris elliptica*, tuba puteh, approximately 75 per cent. of the material has no toxic value at all.

Suggestion have been made therefore, to subject the dried roots to a process of solvent extraction in the country of origin, thereby obtaining a concentrated extract or even a crude rotenone for export. It is thought that there are considerable possibilities in this respect, provided the extract or product does not deteriorate on storage.

As regards the question of deterioration of tuba root on storage, experiments have shown that, provided the roots are dried, there is no appreciable change as regards either the crude rotenone content or the total ether extract after three months storage. For example, in the case of fine roots of *Derris malaccensis*, erect Sarawak, the figures, calculated on a moisture-free basis, for the total amount of ether extract from fresh roots and roots stored for 3 months were 24.8 per cent. and 25.2 per cent. respectively.

Assuming, therefore, the acceptance of an extract by the trade for use in proprietary insecticidal preparations two points arise, the distribution of the toxic principles, including rotenone, in the roots in order to select, as far as possible, for extraction only those portions richest in this respect, and secondly, a suitable solvent.

As regards the distribution of the toxic principles in the roots, experiments are being carried out in which roots from freshly dug plants of different species have been separated into various sizes, each portion being then peeled in order to separate the cortex from the endoderm, the proportions of the constituents recorded, and analyses made of both constituents for rotenone and total ether extract.

While it is realised that peeling especially of the fine roots, is not a practicable proposition on a large scale, the experiments should show definitely the size of roots which it would be an economical proposition to treat, also whether in the case of the coarse roots for example, which are not at present acceptable to the trade but which are comparatively easy to peel, it would be an economical proposition to separate either cortex or endoderm for further treatment.

While no recommendations can be made at present as regards the choice of a suitable solvent, it may be mentioned that ether, although satisfactory for laboratory purposes, would be unsuitable for large scale operations. This is due partly to the heavy losses of solvent which the use of a liquid with such a relatively low boiling-point, 35°C., would entail and also to the fire-risk, ether being a highly inflammable liquid.

The question of the choice of a solvent is also related to the degree of solubility of rotenone regarding which it is intended to carry out some experiments in the near future.

Remarks and Conclusions.

The results of analysis of samples of tuba root drawn from commercial consignments show wide variations in rotenone content.

As a result of the analyses of samples of roots from individual species it appears that the variations are due to commercial consignments frequently consisting of roots from different species of *Derris* and also of varying age.

As far as the results of analysis of individual species are concerned, the figures to-date indicate that *Derris elliptica*, tuba puteh, offers the best possibilities as a source of rotenone. The optimum conditions of cultivation and harvesting have yet to be determined.

The roots of the other variety of *Derris* commonly occurring in Malaya, *D. malaccensis*, erect Sarawak, would appear to be lacking in rotenone.

As stated previously, the results of analysis of the roots of different species for rotenone content are not to be considered as indicative of their relative toxicities. The latter can only be determined as a result of controlled tests on different classes of insects.*

* Arrangements are being made for the carrying out of extensive biological and chemical tests in this Department.

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THE COFFEE CLEAR WING HAWK MOTH

(*Cephonodes hylas* L.)

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When coffee was a flourishing industry, the caterpillars of *Cephonodes hylas* inflicted extensive damage to coffee bushes and were responsible for some reduction in the area of cultivated coffee throughout Malaya.

Ridley ⁽¹⁾ in 1891 drew attention to the fact that the caterpillar of this insect was very destructive to coffee by devouring the leaves and clearing bushes with astonishing rapidity and suggested that it usually attacked weakly plants and wrote in 1900 ⁽²⁾ an account of its life history and control measures "since the enormous damage caused to the coffee in the past two years by the bee-hawk moth (*Cephonodes hylas*) especially in Selangor in the neighbourhood of Petaling caused so much alarm". The next reference appears after an interval of seventeen years by Munro ⁽³⁾ who stated "Touching lightly upon pests, no one who saw and has been made aware of the damage done to estates by the caterpillar of the bee-hawk moth would enter upon the cultivation with the idea that, given good prices, all would be well. Assuredly this pest will make its appearance again but the knowledge of remedial measures is more available now than it was and for safety and insurance against the spread of this devastating pest I would strongly recommend that no large areas be planted without dividing belts".

Richards ⁽⁴⁾ refers to this pest in the same year thus, "Coffee growers should keep a watch for *Cephonodes hylas*, the caterpillars of which have been taken frequently on coffee and *Gardenia*".

In 1928 ⁽⁵⁾ it was stated that this pest had been observed every month, except November and December, and ⁽⁵⁾ in the Annual Report on the Entomological Division for 1928, that its caterpillars had caused extensive defoliation of coffee bushes in Johore and that an encyrtid egg parasite had been discovered and possibly was the responsible agent for the termination of outbreaks. In 1930 ⁽⁶⁾ another brief reference was made concerning *Gardenia* as an alternative host plant of this insect.

Distribution.

The distribution ⁽⁶⁾ of *Cephonodes hylas* Linné is given as the Aethiopian Region, India to Japan, Flores to Australia and the three subspecies thus, *C. hylas virescens* Africa, South of the Sahara and Madagascar, *C. hylas hylas* from Ceylon northward to China and *C. hylas cunninghami* Flores to Queensland. These authors further state that "The

EXPLANATION OF PLATE.

CEPHONODES HYLAS L.

- 1 and 2. Full grown caterpillars, (about nat. size).
3. Branched spines of first instar larva.
4. Egg on young leaf (about nat. size).
5. *Cephonodes hylas* L.
6. Pupae, ventral and lateral views (about nat. size).
7. *Ooencyrtus malayensis* Ferr. (much enlarged).
- 8 and 9. *Stycanopus leucomesus* Walk., dorsal and lateral views (about nat. size).



1



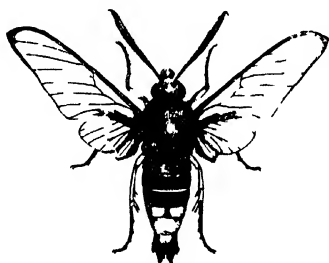
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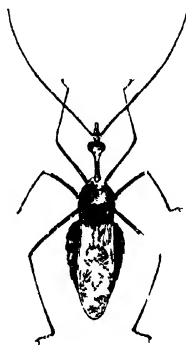
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individuals of *Cephonodes* recorded as *hylas* from the larger Sunda Islands belong to *picus*: no individual of *hylas* has so far been found, to our knowledge, in the Malayan District proper. This is certainly very remarkable, as the insect is common in North Australia, India, China, Japan and Africa".

Cephonodes hylas was reported for the first time in 1925 from Uganda as of minor importance to coffee. In Ceylon it has been for many years on *Gardenia*, in Sumatra it is also recorded as a pest of coffee and in Malaya, for more than forty years, the caterpillars have damaged both *Gardenia* and coffee.

Description of the Stages (V. Plate).

The Moth.

The wings transparent; veins, and anterior border black; bases of anterior and posterior margins of both wings covered with olive green scales. Antennae black, slightly clubbed. Dorsally, head, thoracic and first three abdominal segments olive green, fourth and fifth reddish brown, other abdominal segments yellowish with a reddish brown patch in middle of sixth abdominal segment. Ventrally, head, thorax, middle of first three abdominal segments and sides of sixth and seventh segments white, sometimes slightly yellow; fourth and fifth generally completely red-brown, but frequently centres black; other abdominal segments mid-ventrally black or red brown. Legs white with tarsi dark brown to black. Tail black. Wing expanse about 52 mm.

The Egg.

The egg is subspherical about 1 mm. in length and 0.9 mm. in breadth, smooth, shining and greenish yellow in colour.

The Larva.

First Instar.

Length about 3 mm and breadth 0.5 mm. Head and body at first yellow changing later to dull greenish yellow. Head with simple setae; anal horn black, densely covered with short bifurcate setae and divided with the apex of each fork rounded and bearing a short seta.

The body has two conspicuous subdorsal longitudinal rows of blackish spines, the majority with four branches, some, however, with two and others six.

The first instar larva full-grown is about 7 mm. in length and 0.7 mm. in breadth.

Second Instar. (one day after moulting).

Head, thoracic and anal segments lemon yellow, thoracic and abdominal legs and other segments of the body grass green. Body densely covered with minute black bifurcate spines. Anal horn about 2 mm. in length, black, divided apically and armed with small bifurcate spines. Spiracles greenish in colour. Length 8 mm., breadth 1 mm.

Third Instar.

A marked change in colour has occurred. The colour is dark green with a dorso-lateral white line on each side. The pro-thoracic shield and anal plate yellowish with distinct granules. Above the line of spiracles, which are white with yellow centres, nine black spots, one to each of the second, and the third thoracic and to the first seven abdominal segments. Thoracic legs black at base, rest reddish; abdominal feet dark green. Anal horn black and armed with small bifurcate spines; the body clothed with minute dark bifurcate spines. Length about 15 mm., breadth 2.5 mm.

Fourth Instar. (one day after moulting).

Head and body grass green, thoracic legs at base black, rest reddish brown, and abdominal legs dark purple; a dorso-lateral white line on each side running from head to anal horn is prominent. Immediately below this line a large black spot to each of the meso- and meta-thoracic and the following eight abdominal segments is conspicuous. Spiracles, situated below but slightly anterior to the black spots on the abdominal segments,

are white with orange centres. Pro-thoracic shield especially and anal plate with small granules, some yellowish in colour. Anal horn black and armed with spinous processes. The body comparatively smooth with very minute setae. Length 22 mm., breadth 3.5 mm.

Fifth Instar. (one day after moulting).

Head: grass green, dorsum blue grey, sides, first thoracic segment and anal shield apple green: a dorso-lateral red stripe runs length of the body. Adjacent to this stripe ten black spots from the second thoracic segment to the anal horn. Spiracles white with orange centres and encircled with a reddish brown border. Abdominal spiracles situated below and slightly anterior to the black spots. Below the abdominal spiracles black linear markings present. Above abdominal legs colour deep violet grey. Basal joint of thoracic legs black, others reddish brown. Abdominal feet pinkish cinnamon. Pro-thoracic shield and anal plate with granules, some on the former are yellow, others yellowish green.

Anal horn yellowish green with tip black and with short black spines. Body covered with very minute setae. Full-grown about 70 mm. in length, breadth 9 mm.

Note. The colouration of the various instars has been described from the same caterpillar but the colour is markedly varied in different larvae. Caterpillars may be almost completely black, others may have the dorsum dark brown with lateral splashes of black and red, others again may be green with lateral splashes of black. The colouration of the instars described may, however, be considered as the most general.

The Pupa.

The caterpillar before transforming into pupa is olive green in colour. The newly formed pupa has head and thorax dorsally emerald green, thorax ventrally a deeper green. Abdomen chestnut brown but ventrally intermingled with shades of yellowish green. Subsequently the pupa is shiny blackish brown. Length 32 mm., breadth 7 mm.

Economic Importance.

To estimate the monetary loss due to this insect would be difficult. So many factors have to be taken into consideration, such as the condition of the coffee before attack, the average yield and price of coffee obtaining, the number of bushes which after attack finally succumb to disease—a form of die back—and naturally the intensity of attack on the leaves and berries.

Ridley in 1891 recorded that "usually weakly plants were attacked" but during extensive outbreaks healthy bushes do not appear to escape the attention of this insect. In his paper in 1900 Ridley states "In the beginning of February, six weeks after the caterpillars had been noticed, they had spread over from one half to two thirds of the estate and in many places could be seen rows of from 30 to 40 trees stripped of leaves and with the berries gnawed". Mr. Aldworth in a report to Government, counted at this time of the year 204 caterpillars on an average tree, and estimated that there were 90,000 to an acre or about 22½ millions to the whole plantation. Further he states "The estate coolies being insufficient to keep down the pest, though destroying 300,000 caterpillars a day, the Selangor Government assisted by supplying additional labour and in a few months the plague was so reduced as to be manageable."

Butler⁽⁷⁾, then of the Selangor Museum, writing of the occurrence of this insect stated "There were then (January 31st., 1899) millions of the caterpillars busy at their work of devastation, almost all were full-grown or of medium size. The amount of damage done was extraordinary, a large acreage being

almost completely stripped, as many as 50 or 60 consecutive trees often not having a single leaf left on them. On these trees the caterpillars were busily feeding on the rind of the green berries to which they invariably turn when the leaf supply is exhausted. Whole branches of berries had suffered thus, looking very much as if the rind had been gnawed off by mice".

Mr. F. de la Mare Norris, Principal Agricultural Officer, Johore, reported on the 22nd. December, 1928, that "there is a serious outbreak of *Cephonodes hylas* on coffee at Paloh. The area attacked is estimated at about 1,500 acres out of a total of about 2,000 acres. I gather that the pest has been present for some months. At the time of my visit on 20th. December most of the larvae were in the young stages and the moths were still busy depositing eggs on the coffee bushes. The last generation of larvae was apparently the most serious and a large number of the coffee bushes have been absolutely stripped of leaves — in many cases even the unripe berries have been attacked". The senior writer visited this area on the 3rd. and 4th. January, 1929, when the caterpillars were mostly full-grown and pupae were found without difficulty. The bushes had been almost completely defoliated over an extensive area and new buds as soon as they appeared had been eaten. Not only the leaves but the berries — ripe and green — had been gnawed and even the bark on some bushes had not escaped the attention of the caterpillars. The cultivators had succumbed to the practice of distributing red flags through the area in the hope that through them the pest would disappear. This area was re-visited on the 17th. January, for the purpose of making further observations on the behaviour of the moth and also to ascertain if its eggs were parasitised. Subsequently Mr. Norris sent information that he again visited the area on 25th. March and found a considerable improvement largely as a result of twenty-one notices having been served on the owners to collect the caterpillars. Most of the trees that were badly attacked by caterpillars had subsequently been attacked by a die back and some were shooting out again from ground level, but by April 17th. very few caterpillars were found on the coffee plants.

At Bukit Kapar, Selangor, in addition to a considerable reduction in the yield of coffee following an outbreak of this pest during the last few months of 1929 and the first few of 1930, Mr. A. E. C. Doscas * estimated that five per cent. of the attacked bushes had died as a direct result of caterpillar attack. This area of coffee was under observation until about May, 1931, and although caterpillars had been fairly numerous they had been successfully controlled by frequent hand collection. In November, 1931, the coffee in this area had fully recovered from the 1929 — 1930 attack and the crop production was becoming normal, i.e. after a period of 18 months.

The above survey indicates that a conservative estimate of the reduction of the yield of coffee by this insect over heavily infested areas would probably be in the neighbourhood of sixty per cent.

* Then Agricultural Field Officer, Selangor.

Seasonal History.

The available records have established that this insect has been especially prominent in November, December, January, February, March and April. It has been collected, however, on *Gardenia* or coffee in every month of the year but no reports of extensive damage have been received for the months of May, June, July, August, September or October.

The 1898 outbreak in Selangor was evident in the latter half of December and the 1928 outbreak in Johore in November, the former outbreak appears to have terminated in May and the latter in April. History provides no evidence that this insect was present before December in the Selangor outbreak, but, prior to the Paloh, Johore, outbreak two caterpillars, which were found in July, 1928, on the leaves of Liberian coffee grown on a small holding near Paloh, were received for identification. This is evidence that this insect was present in the Johore area in July, 1928, but not in sufficient numbers to attract particular attention. In December, 1928, the following information was received from Paloh "In the middle of November the pest appeared on coffee trees and I tried to destroy it by removing the larvae. However, it was not effective and on or about 5th. December there again appeared many eggs which hatched within a few days. The pest is multiplying wonderfully and an estate of 200 acres planted with coffee only and adjoining to my own estate is under a condition of total destruction".

The presence of insects is most generally reported when they occur in large numbers but a gradual increase in populace is the rule; moreover the damage to, or decrease in, yield of the plant and not the insect appears to attract first attention, and although excessive defoliation may be noticed in say November, caterpillars in increasing numbers might have been observed several months earlier if plants had been carefully examined. It has already been mentioned that this insect has been collected throughout every month of the year and since an increase would appear to commence about July, it is of particular importance that from that month careful examination of bushes for caterpillars should take place. If this is not performed, defoliated bushes will attract attention probably in about November, when with difficulty and cost this pest may be reduced only after having caused entire defoliation and even the death of bushes.

The factors influencing the increase and decrease of insects are very imperfectly understood. In some cases the presence or absence of disease, often bacterial, is responsible. In Malaya, more especially on the western side, most rain occurs in the months of April and November. The dry months of the year are June, July and August, that is, during the months the increase of this insect occurs. The rainfall may be stated generally to be spread over from October to April—the month this moth would appear to be finally reduced. Rutler remarks that "Very heavy showers of rain at the time when the young caterpillars are hatching and in large quantities are apparently very destructive, washing the tiny larvae off on to the ground in great numbers when, unable to

regain the foliage, they perish in the dust, or are destroyed by ants. Probably warm sunny weather with occasional light showers is the most favourable to a batch of these pests. The heavy showers at the end of February did much to reduce their numbers and the recent drought has also proved very unfavourable to the insects, the pupae dying underground for want of sufficient moisture". Whilst very heavy showers may be responsible for assisting in the destruction of numerous young larvae, the Johore and other outbreaks have extended through the wettest months of the year. Six to seven generations of this insect are possible from October to May. It would, therefore, appear that in the case of this insect, wet weather has no particular influence on its mortality. It has also been suggested that this insect commences to increase during dry weather and this condition would not therefore appear to have any direct influence on the disappearance of this moth. The disappearance of this moth is undoubtedly greatly influenced by the amount of food available. During the visits to Johore a considerable number of almost full-grown caterpillars must have died of starvation, since they were observed eating the remaining portions of leaves, green and ripe berries and even the bark. The moths too were very active, laying their eggs on the remnants of leaves on the bushes. Ridley observed that "when the coffee leaves had been so far destroyed that there was not a sufficient supply for the moths they were seen to deposit their eggs on lalang grass or other herbage". The caterpillars hatching from these eggs would undoubtedly have succumbed as the only alternative food which is not generally available in coffee areas is *Gardenia*. It may, therefore, be considered that starvation is the principal factor in reducing the caterpillars but in addition, the encyrtid egg parasite, *Ooencyrtus malayensis* Ferr., which was obtained from the eggs of *Cephonodes* during the Johore outbreak, on the reduction of caterpillars by starvation, would be enabled to cope with the eggs laid by the succeeding generation of moths. Of two hundred and forty two eggs which were collected in the field at Paloh on January 26th., 1929, *Ooencyrtus* emerged from one hundred and two. It will be realised therefore that this parasite must undoubtedly play an important rôle in the ultimate natural control of this insect.

Habits.

The moth is very active on the wing, flying with great rapidity from one coffee bush to another and is not by any means easily caught. It is diurnal in habit, is seen more especially when the sun is shining and is attracted to coffee flowers for the purpose of sucking the nectar. The distance that the moth is capable of flying is not known but it is undoubtedly very considerable.

The eggs are laid singly, most generally on the undersurface of the youngest leaves. In the act of depositing an egg the moth does not settle but, hovering near the leaf, bends her abdomen forward and almost drops an egg on the leaf where it sticks. Eggs may be laid on the day of emergence but in captivity they have been laid on the fifth day after emergence of the moth. Pairing has

been observed on the day of emergence but generally this does not occur so soon. The copulatory act has lasted for more than four hours. In captivity the largest number of eggs laid by an individual was seventeen, but from dissection, a female would appear to be capable of laying as many as ninety, under normal conditions. The male moth lived in captivity six and the female ten days.

The caterpillar on emergence completely digests the egg shell and feeds subsequently on the surface of the leaf for sometime before devouring the entire tissue. It undoubtedly prefers the younger leaves and has been observed to leave mature for more succulent leaves. In very severe infestations the caterpillars are driven to feeding on the green, then on the ripe berries and finally on the bark of bushes. All varieties of coffee are subject to attack but liberian would appear to be the most favoured. The increase in size of the caterpillar mostly occurs during its last larval instar, about a week before it is full-grown. During this period, its growth is most marked and most damage to the bushes occurs since it consumes an enormous quantity of leaf material.

When alarmed the caterpillars cease feeding and, raising the forepart of their bodies, arch their "necks" and remain motionless. When molested the younger caterpillars secrete a yellowish green fluid and the older caterpillars a more greenish brown fluid which on exposure becomes somewhat golden brown. The caterpillars show a marked colour variation during their life and the uninitiated would probably consider that more than one pest was present. The colouration of the instars of one caterpillar has been described but differences in colour in other caterpillars are frequently very marked. The general colour of most, however, is green with a white or red longitudinal line and black conspicuous spots on each side of the body and all are characterised by a prominent anal horn.

When the caterpillars are full-grown they descend the bushes to the ground and pupate generally about 2 ins. below the surface of the soil. Pupation may, however, take place in any position considered favourable, such as under accumulations of leaves, near the bases of bushes, under fallen timber and indeed in any place which affords some slight protection. The caterpillars at first hollow out a suitable cavity and transform to pupae.

Life Cycle.

The egg hatches in from 3 to 4 days and during the process of growth the caterpillar passes generally through five instars, the first moult in the caterpillar under observation occurring two days after it had emerged from the egg, the second three days after the first moult, the third two days after the second moult, the fourth three days after the third moult and the fifth at pupation, about six days after the fourth moult.

In the process of moulting in the caterpillar under observation, the head capsule was discarded after the larval skin had split at the neck. No cleavage of the median suture was observed. The casting of the head capsule occupied about three and three quarter hours. As soon as the head capsule had been cast, the skin was gradually worked backwards—no cleavage of the skin occurred—the legs being uplifted and the anal horn drawn out. The moulting of the skin was finished in about a half hour when the caterpillar turned round, devoured the cast skin and almost immediately afterwards fed on leaves. During the process of moulting the caterpillar walked about one inch and this appeared to be connected in an attempt to dis-associate its prolegs from the cast skin.

It is interesting to record that a caterpillar which had lost its anal horn emerged as a perfect moth.

The active larval stage of the above caterpillar, on which the colour variation and the length of time of the instars were observed was fourteen days. In other caterpillars which were not disturbed, the length of the active larval stage varied between 12 and 29 days — the majority 21 days. The pupal stage which includes the inactive larval period before pupation, has been found to vary between 12 and 19 days but for the majority the period is 13 days. The Life Cycle may be Summarised thus:—

Egg Stage	...	3 — 4 generally	3 days.
Larval Stage	...	12 — 29	„ 21 „
Pupal Stage	...	12 — 19	„ 13 „
		27 — 52	37

It will be seen therefore that this moth generally completes its life cycle in 37 days and at intervals of about five weeks moths will be present in their maximum numbers.

The Enemies.

Ooencyrtus malayensis Ferr. (8)

The most important enemy of *Cephonodes hylas* is the minute chalcidoid egg-parasite *Ooencyrtus malayensis* Ferr. which was first obtained from eggs of this insect on the 24th. January, 1929, at Paloh, Johore. It would appear to be fairly well represented in Malaya and probably other hosts await discovery. It was first collected in January, 1921, by W. A. Lambourne from Kuala Lumpur, and was subsequently submitted to the Imperial Institute of Entomology by the senior writer from eggs of *Leptocorisa acuta* L., from *Papilio polytes* L. and from *Papilio agamemnon* L.

Description *

Ooencyrtus malayensis Ferr. is a very small insect from about 0.5—0.8 mm. in length. Body black with metallic green reflections on the head and the thorax, more purple on the sides; abdomen brown, with a broad transverse yellow stripe on the base. In the male the thorax is more bronze and the abdomen is not yellow at base. Antennae mostly yellow, and legs entirely yellow.

Habits.

Detailed information concerning this parasite is not available. The time taken from the laying of an egg by the parasite in the egg of *Cephonodes* and the emergence of the adult parasite from the egg is probably 13 days, since, in the collection of 24th. January, the last parasites emerged on the 6th. February.

A *Cephonodes* egg provides sufficient food for the development of at least three parasites. In a collection of twenty one parasitised eggs which were individually kept in different vials, from one egg three parasites emerged, from fifteen eggs two parasites emerged from each and from five eggs one emerged from each. It will be seen that the majority of these eggs supplied sufficient food material for the development of two parasites.

Sycanus leucomesus Walk.

This Reduviid bug is sometimes numerous and has been observed to feed upon both caterpillars and moths of *Cephonodes* using its long curved beak for this purpose. It has, however, little controlling influence.

* Mostly taken from the description by Ch. Ferriere.

Synanus leucomesus Walk. is a black shining insect about 25 mm. in length with a markedly curved beak and with a strongly dilated abdomen. The forewings have a yellowish area about the middle with the membranes bronzy.

The nymphs are easily recognised being orange red with black markings.

Forcipomyia hirtipes de Meij.

In connection with the above mentioned parasitic and predaceous enemies it may be of interest to record that this small midge was collected in the act of sucking a caterpillar of *Cephonodes* and, after removing the caterpillar from the leaf and placing it in a tube, it was still feeding when the caterpillar was examined after about half an hour. The caterpillar was bred through to moth thereby indicating that no permanent injury had been inflicted.

Birds.

Ridley records that the magpie robin and common bulbul devour the caterpillars. They would appear, however, to have little controlling influence.

The Control.

The alternative host plants growing in coffee areas of this hawk moth should be eradicated. *Gardenia* being the only recorded species of plant other than coffee on which the caterpillars feed should not be grown in the neighbourhood of coffee areas.

The records of the seasonal history of this insect have shown that reports of extensive injury to the coffee leaves have not been received before the month of November and have indicated that the increase probably commences during the drier months of June, July and August. It is particularly important, therefore, to prevent the possible increase of this moth, that the coffee bushes during the above mentioned months should be continually examined and all caterpillars destroyed. If an area has been found with numerous caterpillars, especial attention should be directed to that area and the collection and destruction of all the caterpillars should be energetically pursued. The colouration of some of the larval stages resembles so closely that of the coffee foliage that the caterpillars are liable to be overlooked, and although the bushes may be considered to be free it is advisable that they should be shaken vigorously when other caterpillars, if present, will fall to the ground.

The moth is very conspicuous, especially when the sun is shining and flies speedily from one bush to another. In most cases whenever a moth flutters around a leaf she deposits an egg. A constant watch should be kept for the moth, since it is an indication that caterpillars are present. The eggs are small, but with a little experience can be comparatively easily detected since they are exposed most generally on the younger leaves. They should, as far as possible, be collected and destroyed.

The pupae are practically always concealed and may be found just below the surface of the soil, under the protection of fallen timber and accumulations of leaves. Such places should be examined as one destroyed female pupa means that the damage resulting from the attack of about eighty caterpillars is prevented.

Constant inspection of the bushes, resulting in the collection and destruction of the caterpillars, should prevent this insect ever reaching pest proportions, but if this precaution has not been taken and the caterpillars have thereby increased, the above recommendations should be carried out and in addition the leaves poisoned with lead arsenate. An outbreak of this pest, which had been in progress for some months in the Sepang area, succumbed in a very short time to the action of this insecticide, whereas the collection of all stages had previously failed to reduce it to insignificant numbers. Lead arsenate at the rate of 2 lbs. to 50 gallons of water was the recommendation. The advantage of using lead arsenate is that if it dries on the leaf it is washed off with difficulty and will remain effective for some months after the bushes have been sprayed. Whilst recommending lead arsenate, it is realised that it is not within the reach of every cultivator and if it cannot be obtained, the extract from 2 lbs. of tuba root diluted to 10 gallons with water, though not so satisfactory as lead arsenate, will be found to be effective. In spraying coffee bushes or other plants regard must be paid to weather conditions. It is useless to spray when it is raining and inadvisable to do so when the weather is threatening. The best time to spray is in the early morning and when a bright day is anticipated.

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A PRELIMINARY NOTE ON THE REACTION OF PADI SOILS

BY

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In the course of recent investigations on padi soils in the field it was noticed that there were large differences in the pH value of the soils when in the flooded condition compared with those obtaining during fallow, typical changes being from pH 4.5 - 5.0 to 6.5 - 7.0. Further investigation showed that there was a reversal as soon as the irrigation water was run off, the backward change at this stage before fields have dried out, being from about 7.0 to 5.8. In the laboratory changes from 5.2 to 7.1 have been observed in a period of five days.

Changes in a similar direction, but of far smaller extent, have been noted by Subrahmanyam* who observed that both Indian and Rothamstead soils became distinctly alkaline on waterlogging, changes from pH 7.5 to 8.2 being observed. The changes in these latter soils were shewn to be connected with the increase in the ammonia content. Although this may hold in part in Malaya there is evidence that the equilibrium between iron in the ferrous and ferric state plays no small part in determining the reaction of these soils and the possibility of ferrous iron acting as a base must be considered.

Investigations both in the laboratory and in the field are in progress on the mechanism of the changes described, as variations of these magnitudes may be expected to influence profoundly absorption by the rice plant.

* Subrahmanyam, V. *Journal of Agricultural Science*, 1927, Vol. XXVII, page 435 - 436.

Review.

Eleventh Report on Native Rubber Cultivation. Second Quarter 1932.

Prepared by the Bureau of Agricultural Economics of the Division of Agriculture of the Netherlands Indian Department of Agriculture, Industry and Commerce, at Buitenzorg, Java, August 22nd, 1932.

The production of rubber during the period under review, as in previous quarters, bears a close relationship to price movements. During this quarter exports were 5,270 metric tons less than during the first quarter and nearly 13,000 tons less than in the corresponding period of 1931. The exports from Acheen, Tapanoei, Sumatra West Coast, Banka and Billiton have shrunk to minimum quantities, while exports from other regions have also decreased considerably.

The report examines the reaction of various groups of producers to the decision against the introduction of restriction. It is found that the production and export of estate rubber in British Malaya and Netherlands India shew little reaction to the decision, exports of estate rubber from Netherlands India remaining at almost the same level as in 1931, while estate production in Malaya is slightly above 1931 production.

On the other hand, native rubber in the main exporting countries shew a decline in production, such decline being more strongly marked in Netherlands India than in Malaya.

A comparison is also made of the area of tappable rubber untapped. These figures shew that the trend for estates to go out of tapping at first reached greater proportions in Malaya than in Netherlands India. After the announcement concerning non-restriction, however, the latter country soon overtook Malaya. At the end of June 1931, 131,301 hectares in Malaya and 103,561 hectares in Netherlands India of tappable rubber on estates was untapped, representing 23 per cent. and 27.1 per cent. respectively of the tappable rubber on estates.

Thus, although about one-quarter of the tappable rubber on estates in these two countries remains untapped, yet production is about equal to that of the previous year. The publication adds:

"It is not impossible, however, that as far as Netherlands India is concerned, the young plantations which are gradually coming into tappable age and which have never been tapped before and which will also not be tapped now, have been added in the table to the area not being tapped."

Whatever be the system of computation in Netherlands India, the Malayan figure of area tappable at the end of 1931 includes as far as possible, all areas of rubber which have reached a tappable size although owing to economic conditions they may remain untapped at the present time.

D. H. G.

Miscellaneous Articles.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

Second Quarter, 1932.

Rainfall.

The normal spell of dry weather in the first quarter of the year terminated towards the middle or end of April and was followed by weather which was generally showery although the actual rainfall was variable, dry weather being experienced along the west coast and in the plains of Kelantan.

In June, the rainfall in the central areas of the Peninsula was distinctly below normal, with the exception of Pahang, where the fall was up to the average. In Kedah the weather was variable, being wet in the Northern districts during the first week of June. Penang and Province Wellesley experienced showers, and there was a good rainfall in Singapore.

Prices.

A table is given to show the range of prices received by small-holders for their rubber sold to local dealers, together with the average monthly Singapore price for standard sheet for the purpose of comparison with them. The prices quoted at the end of each month by large dealers for small-holders' rubber are also given. All quotations are given in Straits dollars and cents for the price per picul, i.e. 133½ lbs.

It should be borne in mind when comparing these figures that the quotations give the range of prices over a number of buying centres. The following shows the range of prices in dollars per picul for smoked sheet in five of such centres in Negri Sembilan during the month of June

Seremban	\$5 to \$6.	Port Dickson	\$3 to \$5.25
Kuala Pilah	\$4.75 to \$5.70.	Jelebu	\$5.50 to \$6.25
Rembau	\$6 to \$7.		

Tapping.

The general position as regards tapping on small holdings has not shown any very noteworthy alteration since that obtaining during the first quarter of this year. The prevalent increase of interest in rice cultivation is still responsible for much of the large area of rubber out of tapping, the price of the commodity not making it worth the while of owners of padi land, whose time is fully occupied in their rice fields, to employ outside labour for tapping their trees on the profit sharing system, as heretofore. The same applies, to a somewhat lesser extent, to owners who possess land under food crops other than rice, or who have taken up land under temporary occupation licences in order to cultivate such crops.

In a number of districts tapping is done by torchlight before dawn or alternatively, left to children and the less able-bodied members of families; fishing, fire-wood cutting and fruit hawking are some of the many alternative occupations engaged in by the Malay small-holder.

In Malacca tapping on most Malay owned holdings continues more or less normally except for the customary decrease during the padi planting season. The Agricultural Field Officer, Negri Sembilan, reports that during the quarter under review, the area out of tapping has increased by 3,000 acres to a total of some 20,000 acres, i.e. 28.7 per cent. of the total area of mature rubber on small-holdings of less than 100 acres in extent. This figure of 20,000 acres was obtained—it should be added—from information supplied by Penghulus and does not take into account holdings of over 15 acres in extent, so that, since by far the majority of the larger Chinese and Indian owned holdings are out of tapping, the actual total must be greater than that stated above. This increase in the area out of tapping is probably attributable to the seasonal absorption of labour by padi planting, and by durian harvesting and the cultivation of other food crops. The report from Province Wellesley states that according to local dealers, only about 30 per cent. of the normal small-holders' rubber is now being handled by them.

The work connected with bark-consumption investigation progresses favourably, there are, however, 12 out of the ninety holdings under observation i.e. 13 per cent. on which tapping has ceased, but it is probable that a few of these will resume tapping operations in the near future. There is no indication, from the monthly measurements of bark consumption, of any increase in the average rate of excision on small holdings, although in a few districts, notably Muar and Batu Pahat in Johore, it is reported that tapping has become somewhat heavier than is normal, in order to obtain larger yields to counterbalance the low price received. It is not proposed to publish any figures in connection with the bark consumption investigations until the final twelve months measurements have been received and collated, as any data concerning only a few of the holdings is likely to be misleading and to differ considerably from the average over all.

Postponement or Acceleration of bringing Young Rubber into Tapping:

The position with regard to this subject remains unchanged; the amount of young rubber brought into tapping during the quarter has been negligible.

Disease.

Root Disease.—There is no noteworthy alteration from normal conditions to report under this heading. The officer in charge of the bark consumption work states that he has made further investigations in this connection on 25 of the selected holdings. A further tree-to-tree inspection has been made by him and lateral roots have been opened up and examined at from 4 to 5 feet distant from collar around every tree suspected of being diseased. On a total of 416

trees thus opened up he found 5 cases of *Ustulina zonata*, 24 *Ganoderma pseudoferreum*, and 2 cases of *Fomes lignosus*: i.e. a total incidence of 7.45 per cent, all of which were hitherto undiscovered from an above-ground inspection.

Mouldy Rot.—The increase in rainfall since the last quarter has brought a slight correlative extension of the incidence of this disease in many districts, notably Perak Central and South, Selangor, Penang, Kedah and Johore.

Oidium Heveae.—This disease was reported in April to have occurred in Perak South, Negri Sembilan, Malacca and part of Johore, none of the attacks however were of serious consequence. This disease has now been made notifiable by the Johore Government.

Grades of Rubber Made.

The statement made in the report for the first quarter of 1932 that "Unsmoked sheet still appears to be the most popular form of rubber sold by small-holders, more especially by the Malays", still holds good. In Malacca, figures received show that out of the total rubber sold 75 per cent. was unsmoked sheet, 11 per cent. smoked sheet and 14 per cent. scrap rubber. In Perak Central the proportions were as follows:—Unsmoked sheet 45 per cent., smoked sheet 35 per cent. and scrap 20 per cent.

The preparation of slab rubber has increased slightly in popularity in the Krian and Taiping districts of Perak where the price for this product has ranged from \$2 to \$3 per picul during the quarter. In Selangor, however, where previously a number of small-holders prepared slab rubber, the practice is now on the decline owing to the fact that many Chinese dealers refuse to purchase this form of rubber on account of its being frequently adulterated. In the Panchor District of Johore some small-holders sell their rubber in the form of latex, receiving payment on the weight of dry rubber produced from it by the dealers.

Tendency to Abandon Rubber Cultivation for Alternatives.

Reports from Selangor state that the number of owners cutting out rubber in order to make room for food crops has increased considerably during the quarter, the principal areas in which this has occurred being—Beranang, Kuala Lumpur, Klang, Bukit Kapar and the coastal areas of Kuala Langat.

It has not been found possible to estimate the total area on which rubber has been cut down, as in almost every case, only small patches where the growth has been poor, have been cleared for the planting of food crops. Small scale destruction of trees has also been observed in Perak, Negri Sembilan, Singapore, Penang and parts of Johore. A few cases of pollarding have been noticed, where food crops are planted between the rows.

Table of Rubber Prices.

2nd Quarter 1932.

	Singapore Standard sheet Average	Singapore for small holder's sheet at end of month	Penang for small holder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
Smoked sheet.	7.20	5.75	—	5.20-5.50	APRIL						
					5-6.25	5-6.30	4-6	4-7	5-7	5-7	5.50-6.75
Unsmoked sheet.		4.25	5	4.20-4.50	3.50-5.65	4-5	3-5	3.50-6	4-6	3.50-6	2-5.90
Scrap		1.50	2-3	2	1.80-3	1-2.50	1-2.50	1-3	2-4	1-3	1-3
Smoked sheet	7.19	6.25	—	5.30-5.50	MAY						
					5.50-6.70	5-6.75	4-7.50	4-7	5-7	5.50-7.25	4-7
Unsmoked sheet		4.50	5-6	4.50-4.70	4.20-6	4.00-5.30	2-5.75	3-5.50	3-6	4-5	3-6.25
Scrap		1.75	2-3	2.80-3	1.50-3.20	1.50-2.80	1.50-3.40	1-3	2-3	1-2	1-3.50
Smoked sheet.	6.60	5.60	—	5.20-5.50	JUNE						
					4.80-6.25	4.90-5.50	4.50-7	3-7	5-7	5-6	3.50-6.50
Unsmoked sheet.		4.25	4.50-5	4-4.70	4-5.25	3.80-4.50	3-5	2.75-5.25	4-5	3-4.90	3-5.50
Scrap		2.10	2	2.50-3	1.50-2.50	1.50-2.50	50cts-2.50	1-3	1-3	1-2.50	1-3

ENTOMOLOGICAL NOTES.

Third Quarter 1932.

BY

N. C. E. MILLER.

Lac.

It is perhaps not commonly realised that lac, which is used in the manufacture of varnishes, polishes, sealing wax, insulating material for electrical purposes, gramophone records and numerous other articles, is a resinous substance secreted by the female of a small reddish brown wingless insect.

In India, a lac insect, which is closely related to one of the species present in Malaya, has been cultivated with profit for many hundreds of years. The industry is also carried on in Burma, Siam and to some extent in Indo-China.

The origin of the designation "lac" has been traced to the Sanskrit "laksha" meaning a hundred thousand, and one need only observe lac insects at swarming time to satisfy oneself of the appropriateness of associating the word "lac" with these insects.

Lac insects which belong to the Rhynchota or "bugs" can be propagated on several species of trees, for example, in India the following trees are used. — *Butea frondosa*, *Ficus religiosa*, *Zizyphus jujuba*, *Acacia arabica*, Rain tree, *Cajanus indicus* and others. The lac produced by the insects, however, varies in quality and quantity according to the tree utilised.

In addition to lac, a crimson dye is obtained in the washing process which the lac undergoes in the course of preparation for the market. Formerly, this dye was a profitable by-product, but is now of little or no commercial value owing to the widespread use of synthetic dyes.

The young lac insects, the sexes of which are almost indistinguishable, are elongate ovate in shape and red. Each adult female of one Malayan species is capable of producing over 300 individuals.

These, on emerging from the incrustation of lac on the host tree, move to a suitable place on the same tree, and in the course of a few hours, settle down and begin to secrete wax and lac, the wax forming a thin film over the insect prior to the formation of lac. Wax threads also issue from the holes in the covering of lac. These threads eventually, in the case of the females, become so luxuriant as almost to obscure the lac.

Parasites and predators of the lac insect are important factors in the cultivation of lac, at all events as regards the industry as carried on in India. There appears, however, to be no adequate remedy against them at present.

Investigations are being carried out by the Division of Entomology, Department of Agriculture, S.S. & F.M.S., with a view to ascertaining whether a lac insect which is found in Malaya could be profitably cultivated.

Up to now, the species under investigation has been found on *Ficus*, *Macaranga* and *Mallotus*, and an attempt has been made to propagate it on the Rain tree, but unsuccessfully.

Hopes are entertained that it will be possible to extend propagation in a jungle area at present under observation without interfering unduly with the natural surroundings in which the insects live.

Tea.

The tea plant, although it has a number of insect enemies in Malaya, up to the present, has been attacked severely by a few only, of which three or four can be considered as major pests.

These pests comprise a Termite,—*Microtermes pallidus* Hav., a "nettle caterpillar"—*Thoesia lutea* Heyl., a leaf roller—*Gracilaria theivora* Wals., and a grub of a cockchafer beetle which has not yet been identified.

Microtermes pallidus Hav., has been recorded attacking lowland tea and also a manure crop—*Crotalaria anagyroides* and shade trees *Albizzia* sp., the last named only very slightly however.

When attacking a tea plant, the workers of this Termite construct a tunnel, composed of small grains of soil, on the outside of the main stem. The bark under this tunnel is gnawed away, and when the branches are reached, the insects cut through them at the point of junction with the main stem causing them to break off and wither.

The entry into the main stem is sometimes made at points where branches have been pruned and not adequately treated.

Attempts, attended by a certain amount of success, have been made by the writer of these notes to locate nests of this species in order to find the queen. On the one occasion when a nest containing a queen was found, digging had been carried out over two areas having a radius of about 10 feet around *Albizzia* trees.

At first, quantities of the so called "fungus gardens" were unearthed. These lay at depths varying from four inches to about three and a half feet below the surface, and also varied in size from two to eight inches in diameter.

The nest in which the queen was found, was situated immediately below an *Albizzia*.

Control of termites in general and of this species in particular is by no means an easy matter. Paris green applied to plants has been recommended from time to time, but it is not likely to be effective except when it is possible to inject it into tunnels or borings.

Cyanogas is effective to a certain extent, but when the subsidiary nests or "fungus gardens" are scattered over a wide area and are not close together as in the case of mound building species of Termites, extensive digging operations have to be carried out in order to trace the galleries connecting nests, so that the nozzle of the generator can be inserted. The labour expended would about equal that of digging out all the nests.

In view of the fact that it is surmised that *Microtermes pallidus* makes an entry into tea plants at places where the wood is not quite healthy, owing to die back gradually setting in from a pruning point which has not been adequately treated with some antiseptic dressing, experiments which comprise pruning back the attacked bush until all signs of unhealthy tissue are removed, then treating the pruned surface with a mixture of paraffin wax and sulphur or paraffin wax and paris green to protect it until a callus is formed, are in progress.

Although this method at present appears to be satisfactory, it would be premature to state whether it will be effective or not.

The "nettle caterpillar" and the leaf roller have been dealt with satisfactorily by hand collecting; on the other hand, the grub of the cockchafer presents a problem which will require intensive study before adequate and economic measures for control may be established.

This grub lives below the level of the soil at a depth of 4—8 inches, the depth varying apparently according to the looseness of the soil. By gnawing the roots of tea plants it has caused many to die.

As far as one can judge at present, this grub is more destructive in periods of dry weather than when rain falls frequently. This suggests that lack of moisture is the chief reason why it attacks living plants when it can subsist equally well on rotting vegetable matter.

The possibility that plants which are not too healthy, owing to various reasons, are sought by this grub, should not be neglected

Departmental.

THE INTER-DEPARTMENTAL AGRICULTURAL CONFERENCE, 1932

BY

A. THOMPSON (*Joint Secretary*).

Explanatory Preface.

The *Malayan Agricultural Journal* issued in July, 1932, contained an announcement of the proposal to hold the third Inter-Departmental Agricultural Conference at Kuala Lumpur during the period August 2nd.—August 6th. 1932. The objects of the Conference were briefly outlined as follows — “To examine existing agricultural industries, other than rubber, with a view to ascertaining the present position, the immediate outlook and possible improvements and the means of introducing such improvements, using as far as possible existing machinery and resources. It is also intended to endeavour to ascertain what, if any, new industries can be introduced and what industries at present existing on a restricted scale, can be extended with the idea of lessening the dependence of this country on imported staples.”

The opening ceremony of the Conference by H. E. Sir Cecil Clementi, G.C.M.G. took place on Saturday, July 30th. 1932. The Conference was then adjourned until Tuesday August 2nd. and continued for a period of five days.

It was attended by representatives of the Civil Service, the Departments of Agriculture, Co-operation, Irrigation, Surveys, Customs and the Veterinary Department, under the Chairmanship of the Director of Agriculture for the sessions on August 2nd., 3rd. and 6th., the Director of Co-operation for the sessions on August 4th. and the Hon'ble the Acting British Resident, Selangor, for the session on August 5th.

The sessions on the first two days and the fifth day dealt with agricultural problems connected with the following crops — rice, copra, tobacco, fruit, vegetables, coffee, arecanuts, spices (including pepper), tea, groundnuts, sugar. Poultry raising and Chinese agriculture and vegetables were also included.

On the third day, questions relating to finance and general economics of peasant agriculture, with special reference to marketing and grading of peasant produce, were discussed.

At the sessions on the fourth day, draft resolutions embodying the findings of the Conference as a result of the discussions on the preceding days, were submitted and with some amendments, were confirmed. The questions of Agricultural Shows and Home Garden competitions were also considered and part of the afternoon session was devoted to consideration of certain matters in relation to land laws.

A short account is given below of some of the main points which received attention during the discussion of the various subjects on the programme of the Conference.

Rice.

Memoranda on the following subjects had been circulated—

- (a) Irrigation and drainage problems in large and small rice areas.
- (b) Colonisation of rice areas.
- (c) Organisation of supply and distribution of pure strains of padi.
- (d) Possible changes in systems of padi cultivation.

These memoranda were discussed and reports were made of progress in connection with work already inaugurated on lines recommended by the Rice Cultivation Committee.

a. Irrigation problems

The question of provision of labour in connection with development of large and small new rice areas received attention, and it was agreed that whereas in large areas involving the construction of fairly large drainage schemes the bulk of the labour should be provided by Government, in developments on a small scale it was desirable that the people it was intended to benefit should, where possible, be required to assist in the preparation of the land.

b. Colonisation of rice areas.

In connection with colonisation of rice areas it was considered that any schemes designed to secure the extension of rice cultivation in new areas would be unlikely to achieve a full measure of success unless adequate measures were provided to ensure the settlement of prospective cultivators in such areas in a satisfactory manner. It was suggested in this connection that colonisation officers of Malay race should be selected, preferably from the civil and administrative services, for such work. It was thought desirable that such officers should receive a certain amount of agricultural training, and that they should be acquainted with matters relating to the co-operation movement, land laws, irrigation etc. and that they should only be appointed to work in areas where large schemes affecting 2,000 acres and upwards were contemplated.

The question of provision of financial assistance to cultivators in new areas was also discussed, and attention was directed to the somewhat similar provision made in connection with land settlement schemes in Western Australia and elsewhere.

c. Possible changes in systems of padi cultivation.

The Conference was informed of preliminary work by the Department of Agriculture in connection with the growing of food crops on padi areas in the off-season, and of the possibilities in this direction. The question of growing

short term strains to provide for an increased number of padi crops was also discussed and progress in connection with trials of possible strains was reported. Reference was also made to the practice of rotation with grazing which had been successfully adopted in Italy.

It was the opinion of the Conference that in the present economic situation, it was desirable, if possible, to increase the productive capacity of wet padi land, either by growing an increased number of crops of padi, or by growing vegetables or other crops in a system of rotation, or by other means and that the Department of Agriculture should continue to carry on research work in this connection with a view to recommending the adoption of certain ideas if results proved successful.

d. Distribution of padi seed.

The methods now adopted by the Department of Agriculture were considered to be satisfactory. The importance of continuing work already in progress with regard to what has been termed the "filling" capacity of strains of rice, as well as flavour and appearance, was recognised.

The Conference was also informed of the results obtained by the Department of Agriculture in an investigation of methods of sampling of rice areas with a view to determining regional yields.

Copra.

The attention of the Conference was drawn to a publication by Mr. F. C. Cooke and Mr. H. J. Simpson, of the Department of Agriculture, on "Copra Production by the Malay Small Holder", and to a memorandum put forward by Mr. A. T. Newbould, M.C.S. entitled "A Copra Kiln at Sabak" giving details of a small venture in Sabak Bernam, in which he had taken an interest, for improving the quality of copra produced by Malays and also for the sale of the product.

It was considered desirable that efforts on lines suggested in these memoranda should be extended to all parts of the Peninsula where native copra is produced, inasmuch as they appeared definitely to tend to the improvement of the financial position of the raiat, since copra of the quality which could be prepared by small-holders, using the methods and the type of simple kiln described in the memoranda, appeared likely to find appreciably better prices.

In order to disseminate information in this connection and to instruct the growers in the erection of improved kilns and the operation of making and grading copra, it was considered advisable to take steps to train selected Malay Agricultural Assistants in this work.

Tobacco.

A summary of information concerning the possibilities of tobacco growing in Malaya was prepared comprising—

- (a) A statement of Imports;
- (b) A memorandum by the Chief Field Officer on the present position;
- (c) A memorandum by the Director of Agriculture on the possible steps for developing the industry;
- (d) A memorandum dealing with revenue considerations, prepared by Mr. S. G. H. Leyh of the Customs Department, was also circulated.

The matter was discussed at length during the sessions on the second and fourth days.

It was pointed out that the imports of tobacco into Malaya cost the country a great deal of money every year, and that there seemed good reasons to suppose that Malaya could succeed in producing the majority of the types of tobacco consumed in this country. The question of an export trade was not at present contemplated.

It was considered necessary to continue experimental work already in progress with regard to suitable dates for planting in different localities, best methods of curing to be employed and the most profitable types of tobacco to cultivate. It was stressed that the question of marketing should receive careful consideration with a view to circumventing the operations of rings and combines detrimental to the growers' interest.

In view of the highly specialised nature of the crop it was urged that if it could be arranged, the services of an officer with specialised knowledge and training in tobacco growing and curing should be made available.

It was recognised that, in connection with the fiscal side of the question, Government revenue should be safeguarded, and it was recommended that an inter-departmental committee be appointed to discuss the question of duties and to endeavour to devise a formula which would give adequate protection to the Government interest involved and which at the same time would be of such a character as to hamper the industry as little as possible.

Fruit.

Attention was directed to a memorandum by Mr. D. G. P. Olds of the Department of Agriculture, which gave very detailed information on the present position of the fruit industry in one area of the country—Malacca. The survey method was applied in this area, since it was considered that Malacca could be taken as a more or less typical example of a settled area in the Peninsula. In the memorandum certain suggestions were made for the improvement of the fruit industry.

It was pointed out that import and export figures of fruit do not show the real position, since imports are augmented by considerable, but unknown, quantities of fruit which come in, chiefly from the Netherlands India, as deck cargo not entered in ships' manifests.

It was considered that the quantity of fruit at present imported which could be replaced by produce grown in Malaya is considerable and that steps

should be taken to extend the cultivation of fruit by supplying planting material at cheap rates from agricultural stations, instructing growers in methods of fruit growing and by improving marketing facilities. It was mentioned that from time to time, local gluts of fruit occur in certain parts of the country and that this may coincide with shortage in other places. Consequently local market intelligence services would be of value if they could be organised.

It was considered advisable to extend the use of the survey method to other units in respect of the fruit industry and to other products in the case of which it is applicable.

Poultry.

The subject was introduced by a paper entitled "Poultry in Malaya" by Mr. J. Fairweather of the Department of Agriculture.

The paper gave a comprehensive summary of the present position of poultry raising in Malaya, a review of the total value of the import trade in poultry and eggs, and an account of the various breeds of fowls, as suggestions for the improvement of poultry husbandry in Malaya.

It was considered that of all the factors which hampered the improvement of the poultry industry the disease factor was the most important, and resulted in a heavy annual mortality which frequently rendered poultry keeping an unprofitable venture.

The Department of Agriculture had been unable to give much assistance, since there was no officer on the staff who could give his whole attention to the question which required specialised knowledge and study, while the Veterinary Department, through shortage of staff, had not been able to do very much so far in the matter of poultry diseases.

With regard to the question of Pathological research and preparation of vaccines it was considered that on account of the expense involved in carrying out such work, provision for elaborate research could not be advocated at the present time.

From results already obtained in control of poultry diseases by adopting prophylactic measures it was considered possible to effect a great improvement in the situation if poultry keepers could be instructed in such methods.

It was suggested that an essential step was the provision of a trained adviser on the subject of poultry who would be available for the entire Peninsula and in a whole time capacity.

With regard to breeding of fowls it was considered that the establishment of cross breeds was desirable and that the small scale efforts of the Department of Agriculture in this connection at Kuala Kangsar should be extended to other agricultural stations, combined with the establishment of a central breeding station at the Experimental Plantation, Serdang, so soon as funds and circumstances permitted. An interesting account of work done by the Co-operative Department in connection with marketing of eggs in Krian was given. It was

considered that the extension of this work to other units and its further systematisation was worthy of consideration, as and when the opportunity arose. It was thought that in furthering this work the services of a poultry expert would be of great value.

Coffee.

A memorandum which included a summary of imports and exports of coffee had been prepared from answers supplied to a questionnaire sent out to various Agricultural Field Officers.

In the discussion it was mentioned that there did not seem to be any reason why in due course, Malaya should not produce enough coffee to meet the whole of the local demand. Reference was made to existing enterprise in this direction and it was agreed that extension of the industry was desirable.

It was recommended that consideration should be given to (a) better and more extensive arrangements for the supply of cheap planting material.

(b) Instruction in methods of cultivation and manufacture.

(c) Methods of marketing.

It was pointed out that Java coffee, which is the chief competitor of Malayan coffee in the local market, is better prepared than the average local product and that if success is to be achieved an improvement in quality is essential.

Arecanuts.

In relation to this export crop, it was considered that improvement could be effected in the quality, grading and marketing of the product. The problem was in many ways similar to the problem of copra, and it was thought that methods adopted for the improvement of the copra industry among small-holders, would, to a large extent, be applicable to the arecanut industry.

It was suggested that information regarding methods of preparation and grading should be disseminated by Malay Agricultural Assistants and Malay Co-operative Officers.

An account of the efforts of the Co-operative Department to organise the co-operative sale of arecanuts from Perak to Penang was heard with interest and it was urged that greater systematisation of these efforts and their extension to other States and Settlements was desirable.

Spices and Pepper.

Memoranda on the above subject stated that the area under spices in Malaya was estimated at about 800 acres, the principal spices grown being cloves, nutmegs, cinnamon and ginger.

It has been shown that cloves could be grown successfully in inland areas as well as on the coast, but the product was considered not capable of immediate extensions owing to the length of time which lapses before trees come into bearing. Increased interest was being shown in the planting of ginger, which gave a quick return.

With regard to pepper it was mentioned that there appeared to be considerable possibilities for the cultivation of this crop for local consumption and for export. It was contemplated to establish pepper gardens in many of the agricultural stations and it was hoped in due course that planting material would be available for distribution.

Groundnuts.

With regard to this crop it was reported that a large number of varieties had been introduced and were being grown experimentally at the Government Experimental Plantation, Serdang.

It was considered that there was scope for the extension of groundnut cultivation, since groundnut oil is an important article of consumption, and it was suggested that further experimental work should be pushed forward energetically with a view to ascertaining whether the development of the industry was a practical possibility.

Sugar.

The Conference was of opinion that even though Malaya was at one time a sugar producing country, sugar production from sugar cane, on a large scale, was not likely to receive attention at the present juncture owing to the depressed condition of the industry. Furthermore, the capital outlay involved in the erection of sugar factories was considerable and success was only possible if Government would adopt a policy of high protection in order to encourage local production.

It was considered, however, that increased quantities of sugar cane for eating purposes could be produced locally in order to replace the cane imported for this purpose from China.

Tea.

The possibility of the cultivation of tea by Malay small-holders was discussed and it was pointed out that in Ceylon, tea was being cultivated by small-holders who sold the freshly plucked leaf to neighbouring estate factories.

It was considered, however, that there was at present a very limited scope for any development in this direction by Malays, but that the ultimate possibilities should be kept in view.

The Conference was informed of the present position of tea cultivation by Chinese and of the market for certain classes of tea consumed by the labouring classes of Chinese in this country.

The Collection of Economic Data concerning Small-Holdings.

This matter was discussed at length on the third day. The subject was introduced by a memorandum prepared by Mr. R. Boyd, M.C.S., of the Co-operative Department in which the present situation was briefly outlined.

It was pointed out that detailed knowledge concerning the economic position of the Malay small-holder was lacking and that the existing statistical information relating to small holdings, obtainable from mukim registers, statistical reports etc. did not go far enough.

It was agreed that collection of detailed economic data was essential as a basis for operation in efforts to improve the economic position of small cultivators and that in any schemes for collection of such data, the possibility of using existing organisations where possible, should be borne in mind.

It was stressed that the utility of the information to be collected should be carefully scrutinised so that only data with an immediate and direct application should be dealt with in the earlier stages.

It was suggested that a small committee should be formed to examine the position in all its aspects, and to present recommendations to Government with a view to inaugurating the work.

Organisation of District Economic Boards.

A memorandum on this subject by Mr. R. Boyd was discussed. The memorandum explained that the underlying idea of such Boards was to correlate the activities of the District Officers and the specialised Departments in any work affecting the welfare of the raiat. It pointed out that in each District there were representatives of various Departments and that in order to avoid lack of unity, confusion of policy and overlapping, small District Economic Boards should be formed with a nucleus consisting of the District Officer (Chairman), the local Agricultural Officer and the local Co-operative Officer.

It was agreed that some form of organisation was desirable to fulfil the general objects set out in the memorandum and it was suggested that it should be left in the first instance, to the initiative of District Officers to make suitable arrangements in this connection.

The Conference was informed of certain steps which had already been taken in the Districts to achieve the object sought.

Attention was also directed to the benefit which may follow the establishment of mukim committees subsidiary to the District organisations.

The Improvement of Marketing Conditions and Financial Arrangements among Malay Small-Holders.

A memorandum on this subject by Mr. R. Boyd had been circulated. In the memorandum it was pointed out that most of the internal marketing in Malaya was in the hands of Chinese, and that before attempting to alter existing arrangements, full information should be sought and the data obtained carefully weighed in order to find out the present position and the possibilities of improving marketing conditions for the benefit of the Malay small-holder. The difficulties to be expected were explained and reference was made to the efforts of the Co-operative Department in this direction and the experience gained which showed

the necessity for beginning operations on a small scale in order to educate the peasantry gradually in the principles of co-operative marketing.

In this connection it was agreed that the avenue of approach which probably held out the greatest likelihood of early success, was the organisation of small groups of raiats for the manufacture, grading and marketing of certain produce in which efforts should be made to apply sound methods on accepted co-operative lines, without, however, repressing individual ideas and enthusiasm.

With regard to the provision of capital in connection with small marketing organisations, it was realised that while this may at times be a source of difficulty, means could generally be found to overcome the difficulty in a variety of ways and that lack of capital should not form an insuperable obstacle to the inception of such projects.

It was also considered that the necessity for accumulating economic data in respect of conditions in particular areas should be regarded as a preliminary to action and of fundamental importance.

Agricultural Shows.

Memoranda on Agricultural Shows and Home Gardens competitions had been prepared by the Director of Agriculture and circulated. The points raised in the memoranda were discussed at the administrative session on the fourth day.

It was agreed that the holding of Agricultural Shows was desirable, especially during the present period of depression, since such shows exercised an important influence on the quality of the produce grown and also constituted a very important means of disseminating information and fostering competition. The necessity for exercising the most careful economy in this as in other directions was recognised.

It was further considered that the exact form which such shows should take could, to an extent, be left to the judgment of individual District Officers who would consult with the district organisations on the subject.

It was thought that the visit of the Rural Lecture Caravan might usefully be made to coincide with such exhibitions whenever it could be arranged, while the possibility of transporting exhibits of outstanding interest from one exhibition to another on successive days, was worthy of careful consideration.

The question of holding periodically, small competitions in connection with weekly fairs was also mentioned and it was considered that such competitions would probably be of considerable value, while weekly fairs themselves should by all means be encouraged.

It was recommended that the practice of providing special displays and demonstrations concerning subjects and methods likely to improve or increase the production of particular crops and also on subjects concerning the health and general welfare of the raiat should not be discontinued. It was thought, however, that regional selectivity should be exercised in providing such displays and demonstrations so as to ensure that they would appeal to the particular audience concerned, having regard to local conditions and activities.

Home Garden Competitions.

In connection with Home Gardens competitions, it was explained that the movement had taken the form of an extension from School Gardens, the idea being that the pupils, by bringing the information concerning gardens which they had learned at school, into the home circle, might exercise an influence on the community as a whole. It was reported that the movement had already undergone considerable extension in the areas where such competitions had been started, and it was suggested that its extension to all parts of the Peninsula should now be considered and that rules for the conduct of such competitions should be drawn up.

Land Tenure by Malay Small Cultivators.

The question of revision and extension of the methods at present employed for alienation of land to Malay cultivators, and the making of surveys in connection therewith, was discussed.

It was mentioned that at the present time, the cost of the accurate survey required in order to obtain proprietary rights over an area of land was likely to prove an obstacle to the development of new areas by Malay small-holders.

One of the chief proprietary rights was the right to borrow money on the security of the land, and in the past much land had been developed by the small-holders on money obtained in this way. On the other hand, considerable sums of money were obtained for uneconomic purposes.

It was suggested that consideration by Government of the present cost of surveys, and of the necessity for the present standard of accuracy, would be welcomed.

Agriculture on Chinese Small-Holdings.

A memorandum on Chinese agriculture had been prepared by the Chief Field Officer.

The memorandum pointed out that Chinese small-holders produced nearly all the local supplies of vegetables and fruit, and that they also provided a large proportion of the locally bred pigs and considerable quantities of poultry and eggs.

In order to get in touch with the Chinese small-holders, who as a rule do not speak Malay, the employment of Chinese officers was found to be essential. Three such officers were appointed to the staff of the Department of Agriculture and have collected much useful information concerning the agricultural activities, methods, systems of marketing etc. of Chinese small-holders. They have also rendered these small-holders valuable assistance in several ways, notably in matters relating to the obtaining of new land when moved, assisting them to settle on new areas, distributing good planting material, coupled with instruction and demonstration in improved methods of cultivation and preparation of certain crops such as tea, coffee and tobacco. Considerable interest had also been

aroused in connection with the improvement of local pigs by demonstrations and help from the Department of Agriculture's stock farm at Serdang. It was mentioned that while the Chinese market gardeners had little to learn as regards the actual cultivation of vegetables, they often employed objectionable methods of manuring and, in order to bring about an improvement in this respect, work was at present being done to test cheap and efficient methods of manuring not open to any objection.

The Conference agreed that on general grounds it was very desirable to restrict the use of night soil in vegetable cultivation but it was pointed out that the substitution of other and dearer manures might result in an increase in the market price of vegetables.

With regard to the improvement of marketing amongst Chinese small-holders, it was apparent that rings and combines exist among Chinese middlemen which operate adversely to the producers, in much the same way as in the case of the Malay raiats. It was mentioned that the difficulties in the way of organising Chinese small-holders to combat such rings were very considerable, owing to a variety of causes, and it was felt that further economic investigation into their condition was required before any definite action was taken.

In connection with the question of land alienation to Chinese small-holders, reference was made to certain localities where suitable land had been earmarked for Chinese market gardens, close to town and with transport available, on which communities of Chinese market gardeners had been settled. It was pointed out that in several parts of the country market gardeners had done valuable service by reconditioning for agriculture, considerable areas of worked-out mining land.

The necessity for a uniform policy with regard to alienation of land with better security of tenure, was considered to be desirable, and it was thought that if an increased number of longer leases with possibility of renewal were given to genuine market gardeners, the growing of permanent crops by these people would be encouraged.

It was recognised that the Chinese agricultural publication of the Department of Agriculture was serving a useful purpose and it was suggested that the dissemination of similar information through the medium of Chinese vernacular newspapers might also be undertaken.

Conclusion.

The discussion on Chinese agriculture brought the proceedings of the Conference to a close on Saturday August 6th.

On the preceding day, the Hon'ble the Acting British Resident, Selangor, in closing the discussion on the day's proceedings, mentioned that he thought it would be a pity if such a Conference was never to be held again. Although he had been unable to attend all the sessions of the Conference, the sessions which he had attended and the results which had been obtained, satisfied him

that the holding of such Conferences was very desirable and that the resolutions passed were both useful and necessary.

He then moved the following formal resolution:—

"The members of this Conference desire to thank Dr. H. A. Tempany and Mr. A. Cavendish for having called the Conference into being and for the labour undertaken to bring it to a successful termination and they also express the hope that such conferences will be held in future whenever there are matters to warrant them."

In seconding the motion, Mr. E. B. Williams, M.C.S., Commissioner of Lands, Federated Malay States, said that he realised that the District Officer was not the only friend of the small-holder and that an enormous amount of work was being done for the benefit of the small-holder by officers of the Departments of Agriculture and Co-operation. He felt that the members owed a great debt of gratitude to Dr. Tempany and Mr. Cavendish and also to the various officers who had written the various memoranda and he wished to add a special note of thanks to Messrs Thompson, Blacker and Steynes, for the Secretarial work they had performed. Dr. Tempany, Mr. Cavendish and Che Pateh Akhir having replied to the motions, the latter on behalf of the Malay members, the Conference was declared adjourned.

ERRATUM.

Acreages out of Tapping in Netherlands India.

The figures published under this heading in the September 1932 issue of this journal, for the acreages out of tapping in Netherlands India during January, were incorrect; the amended statement is as follows:—

January.	A Totally Ceased		B Partly Ceased		Totals A & B	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Areas in Acres
Java and Madoera ...	99	35,679	47	11,757	146	47,436
Outer Provinces ...	70	24,912	67	25,214	137	50,126
Netherlands India . . .	169	60,591	114	36,971	283	97,562

FROM THE DISTRICTS.

September, 1932.

The Weather.

In the greater part of the Peninsula the weather during the first two weeks of September was hot and dry, while in the second half of the month, showers varying in number and intensity, were experienced. In Penang and Province Wellesley, however, the whole month was very wet, 8 inches of rain falling in 48 hours on the 22nd. and 23rd. and causing flooding in many localities. Heavy rain fell in Krian District at the same time. In Southern Perak and Selangor, rainfall was lighter, but showers were fairly frequent in some places especially towards the end of the month. On Cameron Highlands and in the Negri Sembilan, the middle of the month was dry and the remainder showery, while in Malacca there were heavy showers, with dry intervals in the coastal belt. In Southern Johore and Singapore Island, rainfall was very variable in different localities.

Remarks on Crops.

Rubber.—The price of rubber continued to rise in the early part of September, but declined again later in the month, the uncertainty of the market being reflected in small but rapid fluctuations, which caused some speculation on the part of local dealers in some districts. Price ranges for rubber produced on small holdings were: for smoked sheet \$6.00 to \$13.50, for unsmoked sheet \$5.00 to \$13.00 and for lower grades \$1.00 to \$6.50 per picul. In Singapore the corresponding average prices were \$9.75, \$8.50 and \$3 40 per picul respectively.

The enhanced price, combined in some districts with the completion of padi planting, led Malay owners of untapped rubber holdings in most parts of the country, except the Krian and Selama Districts of Perak and the State of Selangor where padi planting or harvesting were in progress, to recommence tapping their trees. On the great majority of such holdings, tapping once begun was continued throughout the month in spite of the decline in the price of rubber. The increased price was not sufficient to induce the Chinese and Indian owners of properties of intermediate size to tap their trees again, except in parts of Perak South and Selangor, while even on some of these properties, work was soon stopped when the price declined.

Mouldy Rot disease became considerably more prevalent with the incidence of wetter weather and the resumption of tapping. It was found for the first time in the State of Kelantan in three localities near Kota Bahru.

Padi.—The local prices of padi remained at 6½ to 15 cents per gantang in different parts of the country. In Kelantan, Kedah, Penang and Province Wellesley, northern and central Perak and the coast of Malacca, cultivation and transplanting operations progressed well as soon as the water supply became

sufficient. Planting was, however, again delayed by floods in some parts of Province Wellesley.

Planting in the Negri Sembilan, except Kuala Pilah District, was completed, as it was also in the inland areas of Malacca and throughout Western Pahang, where there were prospects of a satisfactory crop.

In Selangor, the inter-season crop was being harvested and appeared on the whole to be a success, but in some localities it did not come up to earlier expectations owing to the large proportion of empty ears. This is, in part, accounted for by the attacks of birds and the padi-fly, *Leptocorisa acuta*, but may also be due in part to other, more obscure causes. Elsewhere in Selangor the main crop was being planted and good progress was made with the establishment of nurseries and the clearing of the timber on the new padi areas in Kuala Selangor District. The Department obtained some 13,700 gantangs of seed padi for use in these new areas, mainly from Krian and Province Wellesley. About 4,000 gantangs of this consisted of seed of different pure strains, while the balance was mixed seed.

In Johore, the growth of the padi, on the whole, was good, though in places it was suffering from drought. Harvesting of both wet and dry padi was commenced in some localities. Crop prospects were fair.

A water gate was supplied in each of the padi areas in the Dindings where bunds were constructed by communal work; as a result, much rain water was conserved.

In Kedah, padi growers, working under the supervision of the Irrigation Department, have constructed a water channel three miles long which supplies about 1,400 acres of land at Sala Kanan. In the mukim of Tubir they have constructed, with the aid of a small Government subsidy, a second channel two miles long supplying some 2,100 acres. At Sungei Lemau in Yen District, a substantial bund 4 feet high and four miles long was constructed by communal work.

Coconuts.—Progress has been made by Malays in the preparation of copra from their own nuts, as is shown elsewhere in this number.

In view of the shortage of locally grown nuts in Kuala Lipis District of Pahang and the surplus production in Temerloh District, a trial consignment of 500 nuts was sent from Temerloh to Kuala Lipis. The consignment sold for a price, which after deducting the cost of transport, gave a better return to the growers than could be obtained at the price ruling in Temerloh District.

The outbreaks of *Artona catoxantha* in Perak and Selangor terminated; the insects in Selangor became much less numerous after a heavy rain storm.

There was a slight rise in the general range of local prices for small-holders' copra, which varied from \$3.80 to \$6.00 per picul.

Tobacco.—The area planted with this crop is increasing in Kedah, Province Wellesley, and parts of Perak and Johore. In Malacca, it is now well established and extending in the inland districts.

A crop of leaf grown at the Pineapple Experiment Station in Singapore Island and cured with toddy, sold for \$60 per picul. Prices for dried and cut leaf in other parts of the country have shown little change from those ruling during August.

Pineapples.—In Selangor, an additional 750 acres and a number of small holdings were planted with this crop during the month, while in Johore, the planting of pineapples as a sole crop was noticeable in certain new areas.

In Johore, small supplies of fruit were available and one factory was working during the month. In the same State a large, new, up-to-date factory is approaching completion.

Malaya continues to enjoy a virtual monopoly of the United Kingdom market for canned pineapples, providing, during the seven weeks ending on the 3rd. September, about 96 per cent. of the total imports.

Fruit.—The fruit season in Kelantan was much later than elsewhere in the Peninsula. During the month durians were still obtainable while mangosteens, langsat and rambutans were ripening. In Johore, dukus were still plentiful. In Penang and Province Wellesley, Perak and Selangor, durians, mangosteens and rambutans were in flower and gave promise of a good secondary crop of fruit, in spite of the good harvest obtained earlier in the year.

Agricultural Stations and Padi Test Plots.

KELANTAN. *Pasir Puteh Padi Experiment Station.*—This station suffered from a severe attack of grass-hoppers spreading from adjoining land which could not be planted owing to drought; however, seedlings in the dry nurseries were suffering so much from lack of water that it was necessary to transplant them before they were sufficiently developed. These factors may adversely affect the results of the trials on this Station, but the grass-hopper attack emphasised the greater vigour of the padi on certain of the manured plots.

It was recorded in certain instances last season that applications of manures produced an improvement in the vegetative growth of padi which was most noticeable soon after transplanting. Such improvement has been recorded again during this month, both on nursery seedlings and on recently transplanted manured plots. Last year it was found that the improvement gradually became less obvious as the padi grew older, until it practically disappeared and that at harvest the increased yield on the manured plots over the controls was profitable in only one or two instances and was not even significant in some cases. Consequently, it will be of interest to observe if these recorded instances of improved vegetative growth are followed by profitably higher yields from the manured plots in the present season.

PENANG AND PROVINCE WELLESLEY. *Glugor Padi Test Plot.*—The second inter-season crop was again a failure owing to the concentrated attacks of birds on the only ripe grain in the neighbourhood. Furthermore, a flood on the surrounding cleared padi land drove numbers of rats to take refuge in the only

growing crop standing above the water and, as soon as the floods subsided, to destroy many of the plants.

Work on other padi Test Stations progressed normally. Wetter weather enabled planting operations to be undertaken on the various Agricultural Stations, more especially on the plots for permanent crops such as coffee, tea, fruit trees, bananas, pineapples and pepper on the newer stations at Selama in Perak, Cheras in Selangor, Rembau in Negri Sembilan, Temerloh in Pahang and Sungei Udang in Malacca.

CAMERON HIGHLANDS. *Tanah Rata Experimental Plantation.*—During the month, work on the pruning programme in the mature tea was in progress and manures were being applied to the pruned fields.

All plots required for an approved scheme of manurial and pruning experiments with tea have been marked out in the planted areas as well as in one field in the new clearing on which a planting distance experiment is to be conducted. Preliminary yields have been taken from the separate plots in the fields of mature tea.

A manurial experiment with bearing coffee has been marked out and the first application of manures has been made.

Plots have been prepared for cultivation and manurial experiments with potatoes.

Village Fairs and Markets.

During the month, 11 new village fairs opened for the first time in Kedah, Selangor, Negri Sembilan and Johore. The rapidly increasing popularity of these institutions is sufficient proof of their success. A new departure is the opening of a market in Ulu Selangor for the sale of vegetables by school children only and this has done much to encourage keenness in the pupils' home gardens. The fairs at Serendah and Kuala Kubu in Ulu Selangor have suffered from severe competition from the Chinese market sellers. In Johore a two day market was started for the first time at Buloh Kasap and proved a great success; it is intended to make this a permanent monthly institution.

Egg Marketing in Krian.—The egg selling scheme of the Tebok Haji Musa Rural Credit Society, under the direction of the Co-operative Department, is rapidly increasing in prosperity, its products being transported for sale in the Kuala Lumpur market. Two cocks, cross-bred from Rhode Island Red and local fowls, are being ordered from the Kuala Kangsar agricultural station with the object of improving the Krian stock.

DEPARTMENTAL NOTES.

Native Production of Copra.

The efforts of the Department of Agriculture to improve the quality of copra from small holdings by encouraging the erection of more efficient kilns and by giving instruction to the native producers in the method of preparation on such kilns, have been extended in several directions, with encouraging results.

In this connection, on September 21st, 1932 a meeting was held at the Coconut Selection and Experiment Station, Klang, of "penghulus" and "ketuas" (local headmen), and Malay copra manufacturers from the three coastal districts of Selangor, for the purpose of discussing the best methods of organising and marketing Malay-produced copra to meet the demands of important European buyers. The meeting was well attended, about 100 people being present, including administrative officers from Klang and Kuala Selangor Districts and representatives of the Department of Agriculture.

An interesting discussion took place, in which recent improvements in marketing and the influence of this new organisation on local prices were contrasted with the condition of the local industry a short time ago. Various questions were brought up for discussion by the Malays.

It was finally decided that the delegates should discuss the various aspects of the problem with Malay producers throughout the Districts, with the object of deciding upon a system of collective selling of the improved copra now being produced.

In Province Wellesley three improved kilns are in course of erection under the guidance of the Malay Agricultural Officer.

Small-holders in the Bagan Datoh District of Lower Perak, realise that it is more profitable to make copra than to sell nuts. The tendency in this District at present, is for individuals to build their own kilns rather than to work in groups with a communal kiln of good design. Consequently, the development in this area requires closer direction.

In Pahang, preliminary enquiries have been made in the Temerloh District as to the possibility of erecting a small kiln of improved type. The suggestion has been well received and is likely to result in action in the near future.

In Johore, the Principal Agricultural Officer delivered a lecture on copra production to Malays at Pontian Kechil, Kukub District. As a result, proposals have been made for the erection of three experimental kilns in this District.

Demonstrations at Padi and Agricultural Stations in Selangor.

During September, demonstrations were held, for Penghulus and village headmen, at the Padi Station—Kuang, the Coconut Experiment and Selection Station—Klang, the Experimental Station—Cheras, and at the Experimental Plantation—Serdang. Three parties of Penghulus visited the Kuang Padi Station on different dates and particular interest was shown in the short maturation

tion strains by the Penghulus from Ulu Selangor, who after seeing the good crops obtained there, expressed their willingness to advocate twice-yearly planting again in the following year, in their several districts. A number of Penghulus and village headmen from Kuala Lumpur, who visited the Cheras Agricultural Station, took considerable interest in the results of manurial trials, tobacco cultivation and kapok budding.

On the 21st. of the month, over one hundred Penghulus and headmen attended the meeting at the Government Coconut Station—Klang, in order to discuss copra marketing problems. An improved type of kiln was demonstrated to them and the details of copra production and marketing were explained. It is interesting to note that, as a direct result of this meeting, all coconut and copra prices were raised by Chinese dealers in the locality in order to discourage the Malays from entering into competition with them.

Two parties of Penghulus, from Klang and Ulu Langat, were conducted over the Government Experimental Plantation—Serdang, on different dates and shown the various economic crops, factories, and the stock farm. Considerable interest was evinced in the methods of fruit propagation which were demonstrated.

Home Gardens Competition in Selangor.

A competition, organised by the Malay Agricultural Officers, Penghulus and Visiting Teachers, for the best gardens cultivated in the homes of Malay school pupils, was held for the first time in Ulu Selangor and Kuala Selangor. Considerable keenness was aroused, as the number of entries and the high standard of the winning gardens proved. The home gardens in Ulu Selangor are decidedly the best in the State.

Rural Lecture Caravan.

In September, the Rural Lecture Caravan, after its return from the Negri Sembilan, commenced a tour of Perak which opened at Simpang, near Taiping, on September 19th. Lectures, film displays and demonstrations were also held at Trong and Padang Gajah, after which the Caravan proceeded to the Dindings from the 22nd. to 26th. Owing to a breakdown after leaving Sungei Batu, which necessitated the fitting of spare parts obtainable from Ipoh, visits to Segari and Lumut had to be abandoned. After visiting Bruas and Manong, the film projecting equipment and exhibits were embarked on a houseboat at Kuala Kangsar on the 29th. for an extensive tour through the riverine mukims of Perak.

Leave.

Mr. J. S. Nornam, Field Instructor and Superintendent, School of Agriculture, Malaya, has been granted 5 months and 15 days leave on full pay, from 16th. September, 1932, prior to the termination of his appointment,

Statistical. MARKET PRICES.

September, 1922.

Rubber.—The price of rubber has fluctuated in Singapore during September from 9 13/16 cents per lb. to 7 5/16 cents per lb., the average price for the month being 8.38 cents per lb. as compared with 7.41 cents per lb. in August. The average London price in September was 2.71d. per lb., and New York 3.77 cents (gold) per lb., as compared with 2.44d. and 3.56 gold cents per lb. respectively in August.

Palm Oil.—The following weekly quotations of palm oil c.i.f. Liverpool, on a basis of 18 per cent. f.f.a. have been received during September: 1st. £17, 8th. £18.5.0, 15th. £18.15.0, 22nd. £18.10.0, 29th. £18.5.0. For the most part the market has been reported as quiet.

Copra.—The Singapore market has continued steady, all supplies being readily absorbed. Prices have shown but small fluctuations. The average price of Sundried was \$5.76 per picul as compared with \$5.55 in August, while Mixed averaged \$5.27 per picul as compared with \$5.04 per picul in the previous month.

Coffee.—Further improvement in coffee prices is recorded during September. Palembang coffee averaged \$19.30 per picul as compared with an average price of \$17.25 in August. Sourabaya coffee averaged from \$23.60 to \$26.20 per picul, the price within this range depending upon quality. The average price of Sourabaya coffee in August was \$22.37 to \$24.01 per picul.

Arccanuts.—Palembangs have remained steady at around \$3 per picul, the average Singapore price for September being \$2.98 per picul. Bila Whole averaged \$3.18 per picul as compared with \$3.25 in August. Average Singapore price per picul of other grades in September were:—Splits \$5.60 to \$8; Red Whole \$6.05 to \$7.10; Sliced \$7.25 to \$8.50; Kelantan Splits \$8.30 to \$9, the price within each range depending upon quality.

Rice.—The following are the average wholesale prices of rice per picul in Singapore during August: Siam No. 2 \$3.88 as compared with \$3.96 in July; Rangoon No. 1, \$3.60 as compared with \$3.73 in July.

The average retail market prices in cents per gantang of No. 2 Siam rice in August were:—Singapore 28, Penang 31, Malacca 28 as compared with 28, 33 and 28 respectively in July.

Gambier.—Block gambier remained at \$6 per picul. Cube No. 1 improved 50 cents to \$12 per picul, the average price for the month being \$11.90 as compared with \$11.62 in August.

Pineapples.—The Singapore market has been lifeless. Buyers are stated to display no interest in the new "pack" as yet. Average prices per case during September were:—1½ lb. cubes \$3.18; 1½ lb. sliced flat \$3.38; 1½ lb. sliced tall \$3.50, as compared with \$3.06, \$3.32 and \$3.42 in August.

Tapioca.—The market has been steady for all descriptions and prices have advanced. Average Singapore quotations per picul during September were:—Flake, fair \$3.33; Pearl, seed \$3.98; Pearl, medium \$4.17, as compared with \$3.15, \$3.87 and \$4.00 respectively in the previous month.

Sago.—Conditions in the consuming markets are firm and local values have shewn some advance. Average Singapore prices per picul in Singapore during September were:—Pearl, small, fair \$4.27 as compared with \$4.25 in August; Flour, Sarawak, fair \$2.27 against \$2.05 in August.

Mace and Nutmegs.—Shortage of supplies have caused nominal prices to advance appreciably. Average Singapore prices per picul for mace during September were:—Siouw \$64, Ambionia \$43.60 as compared with \$48.25 and \$34.75 respectively in August.

Nutmegs 110 per lb. \$23.20, and 80 per lb. \$32.80 per picul as compared with \$22.50 and \$29.50 per picul respectively for the previous month.

Pepper.—Arrivals have been plentiful so that prices tend to be easier. Average Singapore prices per picul in September were:—Singapore Black \$19.10; Singapore White \$25.35; Muntok White \$25.90 as compared with \$18.06, \$24.19 and \$24.65 in August.

Cloves.—Singapore stocks are light, causing some appreciation in nominal quotations. Average Singapore prices per picul in September were:—Zanzibar \$42 and Amboina \$45.60, as compared with \$40.25 and \$42.25 respectively in August.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.*

August, 1932.

Malaya.—Gross foreign imports of rice during August, 1932, amounted to 47,430 tons as compared with 67,862 tons in August, 1931, of which 44.9 per cent. were consigned to Singapore, 16.3 per cent. to Penang, 10.3 per cent. to Malacca, 20.8 per cent. to the Federated Malay States, and 7.7 per cent. to the Unfederated Malay States.

Of these imports 65.1 per cent. were from Siam, 32.9 per cent. from Burma, 0.9 per cent. from French Indo-China and 1.1 per cent. from Other Countries.

Total foreign exports of rice in August, 1932, were 15,861 tons (including 177 tons domestic production, exported from Penang) as compared with 14,480 tons in August, 1931. Of these exports 86.5 per cent. went to Netherlands India 13.5 per cent. to Other Countries.

Net Imports for the period January to August, 1932, were 267,135 tons as compared with 361,578 tons for the same period of 1931, a fall of 26.1 per cent.

India.—Total foreign exports of Rice (*Indian Trade Journal* 1.9.32) during July, 1932, were 119,000 tons as compared with 182,000 tons in June, 1932, and 165,000 tons in July, 1931, decreases of 34.6 per cent. in respect of the previous month and 27.9 per cent. in respect of the same period of the previous year.

Total exports during the period January to July, 1932, were 1,537,000 tons as compared with 1,411,000 tons for the corresponding period of 1931, an increase of 126,000 tons or 8.9 per cent.

Total exports of rice and bran from Burma for the period January 1 to August 27, 1932, amounted to 2,342,516 tons as compared with 2,770,801 tons for the corresponding period of 1931 or a decrease of 15.5 per cent. Of these exports 641,397 tons went to India in 1932 as compared with 1,174,563 tons in 1931, a decrease of 45.4 per cent.

Japan.—The *Trans-Pacific Journal* dated August 18, 1932, states that according to the Ministry of Agriculture and Forestry, stocks of rice in Japan (Proper) on August 1 amounted to 2,734,200 tons.

The anticipated balance on November 1, including imports from Korea and Formosa is now estimated at 748 027 tons.

Siam.—Exports (approximate) of rice from Bangkok during July, 1932, amounted to 100,684 tons as compared with 94,153 tons in July, 1931, or an increase of 6.9 per cent.

Exports of rice from Bangkok during the period December 1931, to July 1932, (the figures for June and July 1932 being approximate) amounted to 966,164 tons, an increase of 143,164 tons or 17.4 per cent. as compared with the same period of 1930—31.

* Abridged from the Rice Summary for August, 1932, compiled by the Department of Statistics, S.S. and F M S

At the end of June 1932 (Principal Trade Commissioner, Ministry of Commerce and Communications, Bangkok) the area under padi in 28 provinces amounted to 1,034,565 acres as compared with 1,466,772 acres at the same time last year or a decrease of 29.5 per cent.

The area under padi for the season 1931—1932 in Siam (whole Kingdom) was 7,726,974 acres as compared with 7,950,208 acres the previous year, a decrease of 2.8 per cent. The total production was 4,036,238 tons as against 4,787,997 tons a year ago.

It is also reported that the total exportable surplus on the 1st of August, 1932, amounted to 306,000 tons of rice.

Netherlands India.—*Java and Madura.* The *Korte Berichten* of August 26, 1932, states that at the end of July, 1932, the area harvested amounted to 7,712,250 acres, an increase of 243,250 acres or 3.3 per cent. as compared with the same period of 1931, the area damaged to 300,270 acres, a decrease of 112,581 acres or 27.3 per cent. as compared with 1931 and additional plantings awaiting harvest to 1,316,000 acres an increase of 187,250 acres as compared with 1931, a total of 9,328,520 acres as compared with 9,010,601 acres for the same period of 1931, an increase of 3.5 per cent.

Imports of rice into Java and Madura during January to July, 1932, totalled 99,050 tons as compared with 172,959 tons for the same period of 1931 or a fall of 42.7 per cent.

Imports of rice into Outer Provinces during January to June, 1932, totalled 123,267 tons as compared with 169,886 tons for the same period of 1931 or a fall of 27.4 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932, to August, 1932, amounted to 809,680 (metric) tons, an increase of 2,460 tons or 0.3 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to August 31, 1932, amounted to 824,637 (metric) tons an increase of 92,962 tons or 12.7 per cent. as compared with the same period of 1931.

Ceylon.—Imports for 7 months to July 31, 1932, were 265,670 tons, an increase of 13,370 tons or 5.3 per cent. as compared with 1931.

Of these imports, 19.9 per cent. were from British India, 69.1 per cent. from Burma, 3 per cent. from the Straits Settlements and 10.7 per cent. from Other Countries.

Europe and America.—Quantities of rice shipped from the East were:—

- (a) To Europe, period January 1 to August 18, 1932, 670,957 tons as compared with 802,802 tons for the same period of 1931, a decrease of 16.4 per cent. Of the 1932 shipments 59.3 per cent. was from Burma, nil from Japan, 33.3 per cent. from Saigon, 3.8 per cent. from Siam and 3.6 per cent. from Bengal, as compared with 67.3 per cent. from Burma, 3.0 per cent. from Japan, 20.4 per cent. from Saigon, 6.3 per cent. from Siam and 3.0 per cent. from Bengal in 1931.

- (b) To the Levant, period January 1 to July 13, 1932, 42,475 tons, an increase of 2,435 tons or 6.1 per cent. as compared with the same period of 1931.
- (c) To the West Indies and America, period January 1 to July 25, 1932, 89,119 tons, a decrease of 18,036 tons or 16.8 per cent. as compared with the same period of 1931.

The *International Crop Report*, Rome, for August, 1932, states as follows:—

“Italy: The area planted to rice this year is estimated at 341,000 acres against 356,000 acres in 1931 and 350,000 in 1926—30.

United States: Reductions in area have been substantial in all States, mostly because of market conditions. Total area is estimated at 845,000 acres against 974,000 acres in 1931, a decrease of 13.2 per cent. and 962,400 acres on the average of 1926—30, a decrease of 12.2 per cent. Production is estimated at 785,700 tons against 908,500 tons in 1931, a decrease of 13.5 per cent., and 866,100 tons on the average of 1926—30, a decrease of 9.3 per cent.”

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN NETHERLAND INDIA AT END JULY, 1932.

		A Totally Ceased		B Partly Ceased		Total A & B	
		Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
Java and Madoera	...	243	148,904	49	18,416	292	167,320
Outer Provinces	...	207	92,356	62	30,541	269	122,897
Netherlands India	...	450	241,260	111	48,957	561	290,217

The total area for July amounts to 31 per cent. of the total tappable area as at the end of December, 1931.

Abstracted from *Korte Berichten*.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT END OF AUGUST, 1932.**

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING				Total (3) + (5)	Percentage of (7) to (2)
		Percentage of		Percentage of		Percentage of		Percentage of			
		Acreage (3)	(3) to (2) (4)	Acreage (3)	(3) to (2) (4)	Acreage (5)	(5) to (2) (6)	Acreage (5)	(5) to (2) (6)		
FEDERATED MALAY STATES :—											
Perak	238,420	21,228	8.9	30,223	12.7	51,451	21.6				
Selangor	294,030	24,250	8.2	37,679	12.8	61,929	21.1				
Negri Sembilan	217,002	22,937	10.6	22,419	10.3	45,356	20.9				
Pahang	35,122	8,460	24.1	4,540	12.9	13,000	37.0				
Total F.M.S.	784,574	76,875	9.8	94,861	12.1	171,736	21.9				
STRAITS SETTLEMENTS :—											
Province Wellesley	44,055	3,434	7.8	10,047	22.8	13,481	30.6				
Dindings	6,700	754	11.3	1,105	16.5	1,859	27.7				
Malacca	110,288	5,879	5.3	22,690	20.6	28,569	25.9				
Penang Island	1,585	1,259	79.4	44	2.8	1,303	82.2				
Singapore Island	28,033	13,885	49.5	3,561	12.7	17,446	62.2				
Total S.S.	190,661	25,211	13.2	37,447	19.6	62,658	32.9				
UNFEDERATED MALAY STATES :—											
Johore	313,385	44,537	14.2	35,241	11.2	79,778	25.5				
Kedah (a)	114,254	9,638	8.4	4,616	4.0	14,254	12.5				
Kelantan	16,785	6,184	36.8	1,590	9.5	7,774	46.3				
Trengganu (b)	4,300	nil	nil	2,072	48.2	2,072	48.2				
Perlis	903	177	19.6	426	47.2	603	66.8				
Total U.M.S.	449,627	60,536	13.5	43,945	9.8	104,481	23.2				
Total MALAYA	1,424,862	162,622	11.4	176,253	12.4	338,875	23.8				

Notes:—(a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

The above table was prepared by the Statistics Department, S.S. and F.M.S.

MALAYAN AGRICULTURAL EXPORTS, JULY, 1932.

Product.	Net Exports in Tons*				
	Year 1931	Jan. to July 1931	Jan. to July 1932	July 1931	July 1932
Arecanuts ...	19,266	12,595	14,096	1,348	615
Coconuts, fresh ...	10,468	4,720	74,272†	917	10,485†
Coconut oil ...	9,909	5,939	6,097	982	910
Copra ...	100,809	47,042	42,716	5,916	5,662
Gambier, all kinds ...	2,563	1,478	1,773	238	271
Palm kernels ...	726	301	591	19	65
Palm oil ...	4,574	2,033	3,813	208	637
Pineapples, canned ...	59,457	41,029	45,006	6,196	7,804
Rubber ...	434,857	246,048	235,677	37,046	35,356
Sago,—flour ...	5,608	1,159	4,139	380*	1,049*
" —pearl ...	2,429	1,128	1,401	221	173
" —raw ...	2,904*	1,072*	2,432*	214*	352*
Tapioca,—fresh ...	9,742	6,507	5,276	1,510	755
" —flour ...	491*	11*	259*	80*	96*
" —pearl ...	19,006	10,786	11,902	1,432	1,455
Tuba root ...	74	36	63	4	13

† '000 in number.

* Net imports.

MALAYAN AGRICULTURAL EXPORTS, AUGUST, 1932.

PRODUCT	Net Export in Tons				
	Year 1931	Jan-Aug 1931	Jan-Aug 1932	August 1931	August 1932
Arecanuts ...	19,266	13,076	13,615	554	481*
Coconuts, fresh ...	10,468	5,325	83,244†	605	8,972†
Coconut oil ...	9,909	6,640	7,322	701	1,225
Copra ...	100,809	60,774	55,185	13,732	12,469
Gambier, all kinds ...	2,563	1,764	2,103	286	330
Palm kernels ...	726	324	752	23	161
Palm oil ...	4,574	2,314	4,547	281	734
Pineapples, canned ...	59,457	45,334	50,729	4,305	5,723
Rubber ...	434,857	282,095	272,085	36,047	36,408
Sago,—flour ...	5,608	1,461	5,226	302	1,087
" —pearl ...	2,429	1,408	1,888	280	487
" —raw ...	2,904†	1,140†	2,696†	68†	264†
Tapioca,—flake ...	9,742	7,020	6,325	513	1,049
" —flour ...	491†	24	190†	35	69
" —pearl ...	19,006	12,754	13,912	1,968	2,010
Tuba root ...	74	41	83	5	20

* '000 in number.

† net imports.

MALAYA RUBBER STATISTICS **TABLE I**
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVENUE,
FOR THE MONTH OF AUGUST, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by 100 acres and over		Production by less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
	Ports	Dealers	Estates of 100 acres and over	during the month	during the month	during the month	during the month	during the month		during the year 1932		during the month		during the year 1932		Ports	Dealers	
				1932	1932	1932	1932	Foreign	Local	Foreign	Local	Foreign	Local					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES:—																		
Federated Malay States																		
Malacca	...	14,443	12,857	11,695	94,194	7,575	59,561	Nil	Nil	Nil	Nil	14,304	5,397	109,310	47,676	...	14,978	11,366
Penang	...	2,834	3,265	3,691	29,189	4,709	27,942	Nil	8	Nil	45	1,130	7,070	7,940	48,788	...	2,957	3,350
Kedah	...	663	2,042	2,448	18,301	1,216	7,093	Nil	Nil	Nil	Nil	705	2,878	5,215	20,005	...	747	2,054
Perlis	...	35	13	9	51	2	47	Nil	Nil	Nil	Nil	Nil	11	Nil	84	...	36	12
Kelantan	...	60	155	153	1,093	307	1,622	62	Nil	283	Nil	74	369	347	2,585	...	148	146
Trengganu	...	55	50	142	825	71	414	Nil	Nil	Nil	Nil	Nil	213	Nil	1,239	...	55	50
Total Malay States	...	18,090	18,382	18,133	143,656	13,880	96,679	62	8	283	45	16,213	15,938	122,812	120,377	...	18,931	17,458
SETTLEMENTS																		
Malacca	...	2,632	1,343	1,397	10,719	...	...	Nil	Nil	Nil	...	4,562	...	31,722	...	...	3,077	1,275
Province Wellesley	...	129	560	507	3,581	...	...	Nil	Nil	Nil	...	...	...	...	...	...	135	561
Penang	...	1,598	2,902	13	2	18	2	243	15,947	3,201	120,493	3,839	Nil	40,519	...	...	223	103
Singapore	...	2,815	13,978	212	155	1,231	...	5,498	39,325	...	...	14,723	...	123,099	...	1,591	4,542	12
Total Settlements	...	4,408	19,798	2,209	2,151	15,299	2,244	15,438	5,741	15,947	42,526	120,493	14,723	123,099	...	2,326	15,701	209
TOTAL MALAYA																		
	4,408	37,888	20,591	20,284	159,956	16,124	112,117	5,803	15,955	42,809	120,538	39,327	15,938	318,173	120,377	3,917	23,569	19,618

TABLE II

Class of Rubber	DEALERS' STOCKS, IN DRY TONS				Produce		Total		
	Federated Malay States	Singapore	Penang	Malacca	Wetly Drying	Jobhere	...	...	...
20	21	22	23	24	25	26	...	...	...
DRY RUBBER	12,287	13,827	4,175	8,235	1,328	34,847	...	...	...
WET RUBBER	3,691	1,874	897	200	1,634	6,766	...	...	...
TOTAL	14,978	15,701	4,542	8,435	2,957	41,613	...	...	...

TABLE III

FOREIGN EXPORTS	PORTS		For month 1932	
	Singapore	Penang	Malacca	Malaya
...	27,400	71,574	3,878	42,485
...	592	6,039	...	...
TOTAL	27,992	77,613	3,878	42,485

TABLE IV

DOMESTIC EXPORTS.			4
AREA	For month	during the year 1932	
Malay States	34,270	337,995	
Straits Settlements	...	...
MALAYA	...	34,270	337,995

- Notes*—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. Columns [7] + [14] + [17] + [18] + [19] + [20] = [21].
3. Dealers stocks in the Federated Malay States are reduced to dry weight by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; 100 acres reduced by 15% to terms of dry rubber.
4. Domestic exports are estimated by deducting the average monthly foreign exports of the Malay States being domestic production.
5. The above, with certain omissions, is the Report published by W. R. Boyd, M. C. S., Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23rd September, 1932.

METEOROLOGICAL SUMMARY, MALAYA, AUGUST, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT				EARTH TEMPERATURE PERATURE		RAINFALL						BRIGHT SUNSHINE					
	Means of		Absolute Extremes		At 1 foot	At 4 feet	Total	Moist in a day	Number of days				Total	Daily Mean	Per cent			
	A.	B.	Max.	Min.					High.	Low.	Precipitation .05 in or more	Thunderstorm				Fog morning obs.	Gale force 8 or more	
	Max.	Min.	° F.	° F.	° F.	° F.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
	° F.	° F.	° F.	° F.	° F.	° F.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
Railway Hill, Kuala Lumpur, Selangor	90.9	71.4	96	69	78	73	83.4	84.6	12.05	306.1	2.37	22	20	7	4	193.20	6.23	54
Bukit Jeram, Selangor	87.9	71.9	92	70	79	74	84.3	86.3	8.54	216.9	2.28	19	14	1		209.25	6.75	55
Sitiawan, Perak	89.6	72.8	93	70	83	75	84.6	85.4	2.61	66.3	0.80	17	13	5	1	237.65	7.67	63
Kroh, Perak	86.7	69.9	90	67	81	72	82.3	82.8	13.19	335.0	2.85	23	18	2		207.25	6.69	54
Temerloh, Pahang	89.9	71.9	94	69	83	75	85.4	85.9	5.47	138.9	1.38	15	13	3	15	186.50	6.02	49
Kuala Lipis, Pahang	89.2	71.2	92	67	85	74	83.9	84.8	3.66	93.0	0.94	19	12	3	23	192.15	6.20	50
Kuala Pahang, Pahang	87.0	73.5	80.3	69	72	79	75	87.2	4.24	107.7	2.07	8	6	2		264.10	8.20	67
Mount Faber, Singapore	86.5	74.9	80.7	72	77	77	82.4	83.4	3.54	89.9	0.58	19	17	2		187.10	6.03	49
Butterworth, Province Wellesley	87.4	74.1	80.8	69	71	84	76	84.3	5.18	147.6	3.04	13	10	1	2	237.10	7.65	62
Bukit China, Malacca	84.4	73.1	78.7	71	79	75	82.6	83.5	5.45	138.4	2.50	18	11			207.05	6.68	55
Kluang, Johore	86.9	70.3	78.6	68	76	72	81.1	82.1	11.37	288.8	2.43	21	16	5	11	144.80	4.67	38
Bukit Lalang, Mersing, Johore	86.8	71.0	78.9	69	76	73	80.9	81.5	3.49	88.7	0.92	8	7			222.05	7.16	59
Alor Star, Kedah	87.9	73.7	80.8	72	84	76	86.8	86.6	6.13	155.7	2.87	15	13	10	1	251.80	8.12	66
Kota Bharu, Kelantan	89.6	73.2	81.4	70	86	77	85.2	85.6	4.86	123.5	1.31	10	10	1		266.50	8.60	70
Kuala Trengganu, Trengganu	89.5	71.9	80.7	68	87	74	84.4	85.0	2.06	52.3	1.28	4	4	1		279.70	9.02	73
HILL STATIONS.																		
Fraser's Hill, Pahang 4268 ft.	73.1	61.8	67.5	59	65	64	71.3	71.9	7.25	184.2	1.65	25	22	2	7	180.30	5.82	48
Pahang. Highlands, Tanah Rata, Pahang 4750 ft.	71.6	56.8	64.2	74	53	67	62	69.4	14.27	362.5	2.82	27	24	3	11	155.45	5.01	41
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	71.0	58.9	64.9	74	57	67	61		14.76	374.9	2.75	27	24		2	163.60	5.28	43

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THE Malayan Agricultural Journal.

NOVEMBER, 1932.

EDITORIAL.

Tobacco.

For many years past it has been usual for Malays to grow small areas of tobacco near their homesteads, or on newly opened land. The crops have been consumed locally and the areas have been so small and the planting so spasmodic as to be without influence on the local market.

Tobacco cultivation has hitherto failed to attract European capital and the isolated attempts that have been made by European proprietary planters to cultivate and market this crop in the form of cheroots have generally failed through lack of marketing organisation, or of sufficient capital.

Fifteen years ago, experiments in tobacco cultivation were conducted by the Department of Agriculture, S.S. and F.M.S. in the Negri Sembilan and Pahang. Reasonably good crops were grown, especially in the latter State, where the soil proved more suitable, but the authors, in their account of this work, expressed their doubts as to whether the progress thus far made in the introduction of tobacco seed proved the suitability of the crop for European planters, especially in view of the fact that from the experiments they were unable to obtain sufficient data regarding yields.

It is to be noted that although the local production of tobacco has been negligible, yet the manufacture of the cheaper brands of cheroot in Malaya has for some years been of importance. This industry developed by reason of the fact that the import duty on unmanufactured tobacco was considerably less than that on manufactured tobacco and on cheroots.

Recent increases of import duty on all classes of tobacco, coupled with the fact that there is no excise duty on locally grown tobacco, has led to renewed interest in the cultivation of tobacco in this country, and there has in fact, been an appreciable increase in the area cultivated by Asiatics.

The fact that the cultivation of tobacco is increasing proves that the Asiatic small-holder has welcomed a crop which in these hard times given him a quick monetary return, although he may be aware that the price he obtains is but a fraction of its true value; also the buyer is obviously satisfied with the present arrangement.

There are, however, definite limits to which expansion of tobacco growing as carried on at present, can develop. The most obvious limiting factor is governed by local demand; this class of tobacco being entirely unsuitable for export purposes.

It follows, therefore, that any considerable extension of the area under tobacco must coincide with the production of a higher grade leaf, in particular a product which is suited to the manufacture of cigarettes. The successful production of a bright cigarette leaf would materially extend the market in Malaya for locally-grown tobacco, especially in view of the cigarette factories now established in Malaya.

It must not be supposed that locally grown tobacco will enjoy definitely freedom from taxation. We regard it as probable that an excise duty would be imposed if Government found that revenue was seriously affected by local production. It is reasonable to suppose, however, that any excise duty levied would be less than the import duty, so that tobacco cultivation in Malaya would receive thereby some measure of protection.

Included in this number is the first of a series of articles dealing with the cultivation of tobacco in Malaya. It deals with the general cultivation of the crop, based particularly on the experience obtained in Malaya and including the preliminary results of work at the Government Experimental Plantation, Serdang. These results are encouraging and although we have not yet reached a point where we can definitely recommend types of tobacco and methods of curing — data which it is hoped will attract capital to this crop — we have taken the first step towards the achievement of our object.

It is apparent from the information available, that definite scope exists in Malaya for the production of tobacco for the purpose of supplying the local market in which the opening is two-fold; firstly, for the type of tobacco for making cheroots and secondly, for bright tobacco used for making cigarettes of the Virginian type.

In our endeavours to establish this local industry we have the example of success under very similar conditions in another colony. The various aspects of this subject are being given very close study by the Department of Agriculture, and in this connection we would mention that we are receiving very material advice from the experts of an important manufacturer of cigarettes.

Tobacco growing is likely to prove suitable for Asiatic small-holders as well as for capitalists, provided that the type of leaf can be established and that a method of curing suitable to local conditions, can be perfected.

The public, therefore, would be well advised to follow the progress of this work so that the opportunity may be taken to apply the experimental results to a commercial scale, thus enabling the local industry to reduce materially the annual bill of over-\$20,000,000 which is the average annual sum expended on the import of tobacco for local consumption.

**San Blas
Coconuts.**

An article contributed to this number by Mr. A. C. Smith, a practical coconut planter, gives an interesting account of the behaviour of the San Blas variety of coconut when grown on the heavy alluvial clays of Malaya.

The author shows that although this variety of coconut is recognised in Central America as prolific, under Malayan conditions it compares unfavourably with the local tall variety of coconut.

The carefully observed comparison of an introduced variety of repute with local varieties is of great value and in taking this opportunity of thanking our contributor, we trust that his experience may prove of value to other planters who in the future, may contemplate the introduction of this variety for cultivation under conditions similar to those recorded in the present instance.

**Agriculture in
Brunei.**

The Director of Agriculture, S.S. and F.M.S., Dr. H. A. Tempany, undertook a visit to Labuan and Brunei in August of this year to advise the Governments concerned on certain aspects of agriculture in those countries.

Labuan, part of the Straits Settlements, was visited by Mr. W. N. Sands of the Department of Agriculture, who contributed an article on the agriculture of that territory in this journal of April, 1930.

Hitherto, as far as we are aware, no account has been published on the agriculture of Brunei. The account which will be found in the current number of this journal constitutes part of the author's report to the Government on his visit.

It will be seen from the following account that the agriculture is mostly contained in small-holdings, and is capable of improvements in several directions with the aid of moderately conceived agricultural services aiming at the provision of better seed and other planting material suitable to local conditions and the general encouragement of agriculture by methods which have proved successful under somewhat similar conditions in other countries.

THE CULTIVATION OF TOBACCO IN MALAYA

BY

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Assistant Agriculturist

AND

N. KANAGARATNAM,

Field Assistant.

The altered economic conditions in Malaya have caused the planting community, especially the small-holder who requires short-duration crops to provide an income, to seek for remunerative crops in place of rubber. Previously, the cultivation of tobacco in Malaya received little consideration, although attempts were made by the Department of Agriculture to bring its possibilities to the notice of cultivators as far back as 1917 (*Agricultural Bulletin, F M S.*, Vol. VI, page 254.)

As rubber is now almost unremunerative, and the import duties on tobacco have been increased, there is a double inducement to the planting communities of all nationalities to grow this crop.

At present there is no excise duty on tobacco in Malaya, but the possibility of duty being imposed must be considered in view of the likely falling off of revenue from customs import duties on the commodity, if local planting becomes extensive.

Customs duties are levied on the dried leaf and the manufactured product, irrespective of their origin, when imported into the Federated Malay States, which includes, Perak, Selangor, Negri Sembilan, and Pahang, or into the Straits Settlements, or each of the Unfederated States of Johore, Kedah, and Kelantan.

Table I shows the import duties on tobacco in force at the present time (June, 1932).

Import duties are not levied on the movement of tobacco from one State to another within the Federation, or within the Straits Settlements.

There is no reason why low-grade tobacco grown in the Malay States should not be able to compete with foreign-grown tobaccos for the extensive markets of Singapore and Penang, but such leaf will, of necessity, have to be of equal, or better, quality to obtain a share of these markets which are at present in the hands of importers of foreign-grown tobaccos.

In Table II the net imports of tobacco into Malaya for the five years 1927-31 are shown.

TABLE I.

Import Duties on Tobacco of the various States of Malaya.

Description of Article	F.M.S. preferential duty on Empire tobacco.	F.M.S.	S.S.	Johore	Kedah	Kelantan.
	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.	\$ cts.
(a) Cigars and snuff	—	1.60 per lb.	1.60 per lb.	1.60 per lb.	1.60 per lb.	1.60 per lb.
(b) Cigarettes	1 00 per lb.	1.10 "	1.10 "	1 10 "	1.10 "	1.10 "
(c) Unmanufactured tobacco	—	70 "	70 "	70 "	70 "	70 "
(d) Manufactured tobacco excluding cigars, cigarettes and snuff.	—	—	—	—	—	—
(i) If imported for sale to the public in air-tight tins or containers.	1 00 "	1.10 "	1.10 "	1 10 "	1 10 "	1 10 "
(ii) Not otherwise provided for.	—	.80 "	.80 "	80 "	80 "	.80 "

The tobacco grown for smoking purposes is generally the species *Nicotiana tabacum*; another important species is *N. rustica* which is grown principally for the production of nicotine for use as an insecticide.

The tobacco plant is very adaptable and thrives over a very wide range of climatic conditions. It follows that a multitude of varieties have been evolved to suit the varying conditions of temperature, rainfall, and the fastidious demands of the trade.

Tobacco thrives best in a fairly light loamy soil. The soil, however, has a powerful influence on the quality and type of the cured leaf; for instance, light loams will produce light-bodied leaves as used for the lighter cigarettes, whereas heavier soils grow full-flavoured thick-leaved tobacco, suitable for che-roots, pipe tobacco and chewing.

It is essential, therefore, that the right type of soil should be chosen on which to grow the tobacco and further, it is necessary that the right varieties for a particular market should be kept in view.

Tobacco thrives best on land that has been recently reclaimed from "Belukar"* or virgin jungle; in general, the best quality tobaccos grow on virgin land. This is particularly true of clay loam soils, and is possibly due to the humus contained in the soil. Humus retains moisture and has an ameliorating effect on the mechanical condition of the land. Areas which have

* belukar, scrub growth on uncultivated land.

TABLE II.
Net Imports of Tobacco into Malaya.

YEAR	CIGARS		CIGARETTES		MANUFACTURED		UNMANUFACTURED		TOTAL	
	Quantity lbs.	Value \$	Quantity lbs.	Value \$	Quantity lbs.	Value \$	Quantity lbs.	Value \$	Quantity lbs.	Value \$
1927	159,425	388,060	7,102,898	17,736,095	5,544,427	4,256,552	6,374,826	2,078,110	19,181,576	24,459,417
1928	98,865	300,917	7,132,069	18,620,822	5,204,669	3,803,965	6,500,114	2,208,792	18,935,717	24,934,496
1929	109,218	337,708	7,648,710	20,006,297	6,093,262	4,211,450	7,681,756	2,451,008	21,532,946	27,648,876
1930	121,046	261,354	5,920,521	16,899,787	6,180,408	3,900,332	7,663,811	2,651,558	19,885,786	23,713,031
1931	80,114	182,176	3,503,537	10,267,096	4,490,116	2,219,625	6,290,958	1,885,337	14,364,725	14,554,234

continually grown crops of tobacco will not produce first quality leaf, regardless of the amount of chemical fertiliser applied. To obtain such ideal conditions as mentioned above, the practice in Sumatra is to grow tobacco once on the same land every seven years, and during the intervening six years to allow the land to revert to "belukar."

If tobacco is grown continually on the same area, the damage done by pests and diseases increases to a marked degree. Should the land be too valuable to be allowed to revert to an uncultivated state, it is advisable to establish a rotation of crops, which should not include brinjal or tomatoes, as these crops belong to the same natural order and are more likely than other crops to carry tobacco pests and diseases.

It is not recommended that tobacco be grown in a rotation more often than once in two years, even when healthy crops have been harvested, and in cases where loss has been caused by pests or disease, it is advisable to allow a longer interval between the crops.

Consideration of the details of cultivation and of pests and disease treatment given below, will clearly indicate that the successful cultivation of tobacco requires considerable expenditure of labour. Prospective growers should bear this fact in mind when deciding on the area to be planted.

Influence of Climate.

The tendency in countries of excessive rainfall, such as Malaya, is to produce a thin papery leaf of large dimensions, with little aroma, gummy matter or nicotine, and for this reason it is recommended that tobacco be planted at the beginning of the long dry season. This tendency renders necessary very careful investigation in the field before recommendations can be made for the commercial growing of Virginia types which are used for the preparation of all the well-known brands of Virginia cigarettes and must exhibit certain definite leaf characters. Although two Virginian types, Joyner and Hickory Prior, were included in the trials described in this article, it must be clearly understood that their cultivation is not yet recommended by the Department of Agriculture; moreover, experience in other countries indicates that recommendations for manuring given on page 561 may need considerable modification if loss of quality in these types is to be avoided.

Varieties taking an average of about 130 days from sowing the seed to harvesting the crop are planted at the Government Experimental Plantation, Serdang, during the month of March; this practice results in the plants growing good marketable leaves with heavy body and aroma and allows of the harvesting of the crop during the most suitable weather of the year.

Manuring in the Field.

As previously mentioned, tobacco thrives best on land containing a fair proportion of humus. Humus derived from decaying vegetable matter is con-

sidered preferable to that resulting from the application of heavy dressings of cattle manure, since it is likely that such heavy dressings on average soils contain more nitrogen than is required.

If virgin land is not available, or green manures cannot be incorporated into the soil, moderate dressings of cattle manure up to about 10 tons per acre are recommended, and in order to balance the principal ingredients of plant food in the soil for this crop, applications of phosphates and probably of potash, will be necessary.

All the manures should be applied whilst the land is being prepared for planting, preferably before the last ploughing or turning over of the soil.

The following dressing of chemical manures might, with advantage, be applied in addition to the cattle manure, or a similar application of green manure :—

Basic slag	...	2½ cwt. per acre.
Sulphate of potash	...	½ cwt. per acre.

Should the tobacco plants be slow-growing and not of a deep green colour, it may be advisable also to give a top-dressing of about ½ cwt. per acre of nitrate of soda or calcium cyanamide.

Experiments on the manuring of tobacco at the Government Experimental Plantation, Serdang, have shown that on a poor, gray, sandy-loam of known infertility, the application of heavy dressings of a complete mixture of chemical fertilisers* without farm-yard manure gave negative results. This was also true of plots on which a concentrated organic mixture was applied. Cattle manure without inorganic manures gave a good growth, but cattle manure and chemical fertilisers together gave slightly better results. This soil is not typical and the results should not be taken as being of general application.

Influence of Fertilisers on the Leaf.

Excess of nitrogen in the soil will cause the crop to grow too vigorously, producing large plants having thin papery leaves. Phosphatic manures have a tendency to accelerate maturity.

Potash has an influence on the burning quality of manufactured leaf. An abundance of this element in the leaf induces free burning and the production of a white ash—desirable characters in a cigar tobacco. A deficiency of potash is said to derange the metabolism of the plant, resulting in distorted, crinkly leaves similar in appearance to those of the savoy cabbage; this effect is most noticeable during the second month of the life of the plant. A similar appearance may, however, be caused by a disease.

Soil and Situation of Plots at the Government Experimental Plantation, Serdang.

Experiments on tobacco were conducted in the General Nursery during 1931.

* Ammonium sulphate, superphosphate and sulphate of potash in 1931.
Calcium cyanimide, basic slag and sulphate of potash in 1932. .



HICKORY PRIOR 'BAGGED' FOR SEED



TOBACCO NURSERIES SHADED WITH ATTAP THATCH.



TOBACCO NURSERY SHADED WITH CALICO :
GOVERNMENT EXPERIMENTAL PLANTATION, SERDANG.

The soil might be described as a well-drained, light, sandy loam, fairly dark in colour, varying to a medium brown loam.

Preparation of the Nursery Beds.

Nursery beds about three feet wide, were made with one-foot-wide paths between each bed.

The surface of the soil of these beds was scorched by burning dry palm leaves and rubbish which had been spread during dry weather to a depth of about 6 inches. The soil was afterwards turned over and the scorching repeated a second time.

Well decomposed cattle manure at the rate of about 10 tons per acre was dug into the soil and a fine seed bed prepared by further cultivation.

Care of the Young Plants in the Nursery.

Young tobacco plants are very delicate, they cannot withstand the beating action of heavy rain, and they thrive best if protected from the direct rays of the sun, for the excessive moisture in the nursery beds encourages fungus diseases to attack the young plants; for these reasons arrangements must be made to protect the plants and it is customary to shade the nursery beds with strips of calico.

At Serdang for this purpose, hard-wood posts were placed at the four corners of each bed, that is, at intervals of 33 feet, to which were attached wires of about No. 12 gauge. Three wires were stretched along each bed, the width between the outside wires being 30 inches, the side ones being about 1 foot above the ground and the centre one about 15 inches high; the wires were also stretched across the ends of the beds. To these wires was fastened bandage cloth or unbleached calico, 34 inches wide, which had been dipped into "bakau" dye to preserve it against the action of sun and rain. The calico was fastened by folding the edges over the wire and pinning with the midrib of coconut leaflets. Pins of split bamboo would be equally suitable for this purpose.

The cloth which is known locally as "kain belachu" cost about \$2.20 per roll of 26 yards.

Woven ataps*, such as are used on bullock carts might be employed instead of calico.

The above practice provides top shade and protection from rain, but an alternative method would be to use a wider cloth and close up the sides at night to stop the ingress of insects, so preventing them from laying their eggs on the plants. In the latter case, weights would be used to keep the cloth in position and the pins would not be necessary.

* "ataps" = palm leaves, used as a roofing material.

This alternative method would also facilitate watering and attention to the plants, as in any case it is necessary to remove the cloth periodically. Weights would be easier to remove and replace than bamboo pins.

It is essential that the beds should not be kept too moist; excess of watering or rain will encourage damping off, which is caused by a fungus attacking the tiny seedlings. When tobacco is grown on small areas, the seedlings may be raised in boxes under shade.

Watering is preferably carried out in the evenings. Morning watering tends to cause a hard, compact top-soil in the beds, resulting in great loss of moisture from the soil surface by evaporation. This applies more to nursery beds exposed to the direct rays of the sun than to the shaded beds. Should the watering be carried out in sunshine the leaves will be scorched.

Sowing the Seed.

One ounce of tobacco seed contains about 300,000 to 400,000 seeds; this amount, allowing for the usual high percentage of losses, under expert management is sufficient to provide plants for four to five acres. For a 3 feet wide seed bed, one chain long, on which the seed is sown on a central strip $2\frac{1}{2}$ feet wide, a teaspoonful of seed only is required. To facilitate sowing, the seed should be mixed with a half pound of fine sand, wood ashes, or a similar amount of a dry, non-acid artificial manure such as sulphate of potash.

The seed should be sown on very fine well-prepared seed beds and it is unnecessary to cover it. The surface, however, should be lightly pressed to consolidate the top soil, subsequent watering with a very fine spray from a watering can being sufficient to wash the seed into the surface of the bed.

The treatment for the following two or three weeks consists of gently watering and hand-weeding. A careful watch for insect pests must be maintained and hand-picking of all types of leaf-eating insects should be carried out daily.

The seed takes about six days to germinate. It is desirable, after the seedlings have made a little growth, to remove the shade for an hour or so each morning and evening so as to harden the seedlings and prevent them from growing too tall. This exposure can be lengthened as the seedlings become older.

The aim is to grow very short-stemmed plants producing wide, round leaves fairly close to the ground: such seedlings can only be obtained by growing on a fertile soil and with an adequate control of light and moisture.

If the germination of the seed is good and the seed bed becomes overcrowded, it will be necessary to thin out from the most congested places and to transplant the lifted seedlings into similar, covered nursery beds. This operation can be carried out when the plants are about two weeks old. It has been observed at Serdang that such transplanted seedlings suffer no setback and eventually produce excellent plants, maturing a few days earlier and producing a yield of leaf in no way inferior to that obtained from the plants left in the original beds.

It must be appreciated that the young tobacco plant is exceedingly delicate and requires considerable attention during all stages of its growth. It is a valuable crop and the financial return from a correctly grown crop should amply repay the cost of close attention during the whole period of growth.

Preparation of the Land.

As practically no land in Malaya is sub-soil drained, it is necessary, on flat land, to plant the seedlings on raised beds. This not only facilitates drainage but allows of access to all the plants in the area.

Such beds, about 4 feet wide, will allow of two rows of plants, spaced on the triangular planting system, about 2 feet 8 inches apart giving a distance of 3 feet between the plants, and a margin of 8 inches from the outside plants to the edge of the path. Allowing for paths one foot wide, this arrangement gives approximately 5,800 plants per acre.

The planting distance should depend on the variety grown. The experience gained at the Government Experimental Plantation, Serdang indicates that the following varieties require the full 3 feet spacing:—Joyner, Hickory Prior, White Burley, Jaffna, Burmese tobacco, Deli, Thattayan, and Dunbara whilst the other varieties tried, namely, Burmese Havana, Bhengi, Shwegyan may be planted a little closer.

The planting distance also depends on the fertility of the soil, on rich lands the plants being spaced wider; on poor land the fertility should be improved by the application of manures and the distance allowed as detailed above.

An alternative method on wet land is to plant on ridges which can be spaced about 3 feet apart.

On free-draining, sloping land the usual method of planting is on terraces.

The land must be ploughed or dug over and if the tobacco is grown on a rotation of crops system, a dressing of well-rotted cattle manure should be applied at the rate of about 10 tons per acre. If cattle manure is not available, it is recommended that a quick-growing leguminous, green-manure crop should be grown, preceding the tobacco, and be incorporated into the soil when still in the green state but almost mature. The planting programme should be so arranged that this operation takes place about six weeks before the tobacco is ready to transplant. Suitable green manures for this purpose are horse gram, soya beans, cow peas, or some of the well-known cover crops.

An alternative method of green-manuring suitable for the small-holder is to transport from nearby land succulent green leaves or herbage and incorporate it into the soil some time before planting the tobacco.

It is recommended that the whole of the beds be manured rather than to confine such manuring to the sites occupied by individual plants.

About two months after sowing the tobacco seed, the plants should be about 4 to 6 inches high, well developed, sturdy, and fit to transplant into the field. All sickly, badly grown or "leggy" plants, including those with twisted roots, or showing signs of disease, should be discarded. In this connection, good-

looking plants showing slight black streaks on the roots should be burnt as these indicate attacks of fungus diseases.

The plants should be carefully lifted and transplanted without loss of time, care being taken that the seedlings are not exposed to the sun. In well-cultivated land, the plants can be dibbled in by making a hole with a pointed peg, into each of which a seedling is planted, precautions being taken to ensure that the tap-root is not curved while being planted. The soil should be firmly pressed on all sides against the tap-root, while on the heavier soils care must be exercised to avoid leaving an air pocket at the bottom of the dibble-hole.

It is essential that the plants be lightly shaded by a few small, leafy branches or palm leaves, placed a few inches distant in a leaning manner to over-hang the transplanted seedling. The leaves of such shade will shrivel and die in a few days and will gradually allow more sunlight to penetrate to the plants and may be removed after about one week to ten days.

Transplanting should be carried out in rainy weather, preferably in the evening.

Should the weather after transplanting become dry, the cultivation of about two inches of the surface of the ground will form a mulch and preserve the soil water. This method is better than early resort to hand-watering, but if the rainfall is so light that hand-watering is considered necessary, then it should be accompanied by surface cultivation, as watering consolidates the surface of the soil and causes excessive losses of moisture by evaporation. In this connection, it must be remembered that the crop is being grown during the dry period of the year.

During the growth of the crop, a certain amount of surface cultivation will in any case be desirable in order to check the growth of weeds.

Priming is the operation of removing two or three small basal leaves from the plants; this appears to invigorate the plants and causes them to grow faster and more robust; it also allows a free passage of air at ground level which tends to decrease the incidence of disease.

Topping.

For the production of high grade leaf, except for special markets, it is necessary to prevent the plants producing flowers and seed. If very thick, gummy leaves for fillers in cigars, or for chewing tobacco, are required, then only a limited number of leaves per plant must be allowed to mature and consequently low topping will be necessary, on the other hand, if the market requires a light-bodied leaf for such a trade as cigarettes and cigar wrappers, then higher topping may be practised.

Very low topping, allowing only 5 or 6 leaves per plant, will tend to produce a very rank and coarse tobacco.

For the production of seed, a few good plants should be allowed to flower. Flowering plants of different varieties should be grown at distances as far apart from each other as is practicable in order to prevent cross pollination and the



TOBACCO PLANT, 3 FEET HIGH FOR TO NG



TOPPING THE TOBACCO PLANT



TOBACCO PLANT AFTER TOPPING



WHITE BELLY TOPPED FOR LEAF PRODUCTION

consequent production of hybrid seed.

Should it be impossible to grow the different varieties for seed at some distance apart, then in order to produce pure seed, recourse must be had to bagging the flowers. The disadvantage of bagging is that a very much lower quantity of seed will be produced per plant, as the flowers are not so freely fertilised when thus confined. Muslin bags about 2 feet x 2½ feet are ample in dimensions; these should be placed over the flowers and tied around the main stem. One unbagged plant will, under ordinary conditions, yield about a quarter of a pound of good seeds, but it will probably require half a dozen bagged plants to yield a similar amount.

Suckering.

At the Government Experimental Plantation, Serdang, about 5 days after topping it has been found to be necessary to remove the suckers which grow from the axils of the leaves. These suckers must be removed as they appear, and certainly before they have attained one inch in length, otherwise they will deprive the leaves of the nourishment conserved for them by the operation of topping. Such suckers should be nipped off by means of the finger nails as close as possible to the axil of the leaves.

Harvesting.

The time of planting of tobacco must be so arranged that the maturing and harvesting occurs during the dry weather. Should rain fall during the harvesting operations, it is advisable to postpone the work for a few days if possible, to permit the plants to produce a layer of gum on the leaves to replace that which has been washed off by the rain.

Leaf gum probably aids fermentation and helps to develop the desired aroma. Gummy leaf is greatly appreciated for pipe and cigar fillers by manufacturers. The danger of a delayed harvest is the rapid development of spots on the leaves, which become numerous as the plants get older. At the same time, in spite of a few spots, it is necessary to allow the lower leaves to attain their maximum development.

Tobacco is harvested when the leaves are in the green stage and have begun to droop. At this time, leaves become dark green and slightly more crinkled and the main stem turns a pale green.

As the tobacco plant approaches maturity, the main stem and mid-rib of the leaf become brittle, whereas previously they were tough and would bend rather than break. It is necessary to judge the ripeness of pale green leaved varieties such as "White Burley" by applying the last mentioned test.

Systems of Harvesting.

- (1) Harvesting single leaves in several rounds.
- (2) Harvesting two or three basal leaves and afterwards the whole plants.

(3) Harvesting the whole plant in one operation.

The harvesting of single leaves can only be applied to small holdings or, in the case of large estates, where labour is cheap and plentiful. The operation is usually divided into about three harvesting "rounds" at intervals of several days.

The first leaves to be collected are those liable to touch the ground and so become damaged. Such leaves are often picked when in the early stage of ripeness, the remaining leaves being collected as they ripen.

In the second method, the basal leaves are harvested for the reasons mentioned previously, later the plant is cut a few inches above ground.

The third method, that of harvesting the whole plant in one operation, is usually confined to the coarse varieties.

Treatment of the Crop after Harvesting.

When individual leaves are cut they are withered by hanging in sheds by the leaf stalk, on ropes, poles or wires. The air-drying barn is usually built of attaps or thatch, with sides, doors and windows of the same material. The windows must be capable of being opened, thus allowing of some control of the barn temperature and ventilation.

If the whole plant is harvested in one operation, it is usually effected by cutting the stem with a knife about six inches above the surface of the ground. This operation must be carried out when the leaves are dry, that is, after dew or rain has dried off. The plants are hung in the withering barn by passing a stick 3 to 4 feet long through the main stem near the base; the stick carrying several plants, is placed on cross members in the withering shed. It is advisable to have the plants so spaced that they do not touch each other. An alternative arrangement in the drying barn is to pass short pegs through each plant and hang them by means of the peg on to poles set close together in the withering shed. The plants are hung in tiers one above the other, to the top of the shed.

If it is desired to keep the leaves more separate from each other than is possible by hanging whole plants, then the main stem can be cut transversely between each leaf, and each leaf, with a small portion of main stem attached is hung by the simple process of hooking it on to a wire or rope. Other methods of hanging the individual leaves are by loosening the strands of a stretched rope and placing the leaf stalks in the opening so made, afterwards allowing the strands of the rope to close on the stalk, or by cutting a cleft in the leaf stalk and by means of the cut hanging the leaf onto a stretched wire.

The following are abstracts on air-curing by Corbett, Bulletin 33, Department of Agriculture, Mauritius, which apply in general to the air-curing of tobacco for heavy cigarettes and cheroots:—

"Air-curing consists of allowing the leaf to go through a natural process of curing without the aid of artificial heat and the success of the curing is to a great extent dependent upon the atmospheric conditions prevailing. A good deal can be done to control these conditions by suitable

barns in which ventilation is under control, and small barns give better results than large ones.

The curing goes through two stages, the first commencing when the leaf is harvested, by cutting the plant just before the maturity of the leaf is fully ripe, and ends at the disappearance of the green colour which is replaced by a lemon yellow colour. It is during this stage that the barn must be so regulated that the leaf does not dry too quickly or too slowly. If it dries quickly the leaf will retain its green colour and be of little value, and if too slowly the curing will be carried too far. This stage is really a process of slow starvation and the most favourable conditions are obtained with a temperature of 28° — 38°C . and a humidity of 35 per cent. (82° — 100°F .).

From this stage the leaf passes to the second stage and in order to get the bright leaf, the curing must be hastened by reducing the moisture in the barn and hastening the drying. This is a difficult matter during wet weather and the leaf during such times will invariably become a dark colour, but in a good season, by careful ventilation at the top and bottom of the barns, a good percentage of leaf suitable for manufacture of cigarettes will be forthcoming.

During wet spells a good percentage of the leaf can be saved by building small charcoal fires under the tobacco, the heat will prevent the curing being carried out too far by excess of moisture. By raising the temperature of the barn 20°C . the capacity of the atmosphere to hold moisture is doubled and if it is possible to keep the temperature of the barn 20°C . above the outside atmosphere during wet spells together with a little ventilation, the elements can be controlled. During such a period the bottom ventilation should be reduced and the top ventilation slightly increased.

The most suitable conditions for air-curing are clear, calm days, with a moderately dry atmosphere and a temperature of 26 — 32°C . (79 to 88°F .). Under such conditions the moisture is absorbed by the atmosphere as quickly as it is given off from the leaves and therefore oxidation does not take place.

During dry weather when the leaf is inclined to dry out a green colour, moisture should be introduced by wetting the floors of the shed during the first stages of curing, and the colour will depend on the way moisture is withdrawn during the second stage.

The best type of barn is one which can be filled in one or two days, and should be fitted with good ventilation at the bottom and top, so that the barn can be entirely closed if desired. A good size for a plantation of 5 acres or more is 32 feet x 16 feet x 7 feet to sill inside measurements. The interior of the barn should be fitted up with tiers which greatly facilitates the work."

Sweating of the leaf on the pole is caused by stagnation of the air and an atmosphere that is too humid. If the sweating is allowed to continue, the stalks will rot at the point where they are attached to the poles, wire or ropes; this condition indicates that the withering process is proceeding at too slow a rate and necessitates the use of a charcoal burner to hasten the process by raising the temperature of the atmosphere in the barn.

It has been observed at Serdang that the yellowing takes about six days, the room temperature varying between 80 — 90°F .

The withering of tobacco for cheroots occupies about 13 days. If the weather towards the end of the withering process is very dry, the withered

leaves will lose too much moisture and will be brittle and difficult to handle without damage. To prevent this, it may be advisable to water the floor so that the leaves will absorb moisture, so making them tough. An alternative method is to allow free ventilation to the withering shed during the night before the leaf is removed for fermentation; on the following morning the leaf will be found to have absorbed sufficient moisture to permit of handling without damage. Excess of moisture of the leaf will cause a rotting of the leaves during fermentation.

Fermentation for Cheroots and Chewing Tobacco.

This process depends on the amount of moisture present in the leaf at the conclusion of the withering process. At the Government Experimental Plantation, Serdang, when handling small crops, 25 per cent. of moisture appears to be about the optimum amount, as in trials, withered tobacco containing approximately this amount gave the best fermented leaf.

One method for fermenting consists of stacking the leaves, which have been stripped from the main stem, to form a circular heap about four feet wide and about six feet in height, the tobacco leaves being placed with the leaf-stalks to the outside and the stack built with a diameter sufficiently large to leave a small vertical funnel through the centre of the stack to permit of the insertion of a thermometer.

The leaves are laid flat and straight, the whole stack is covered with sacks or canvas to maintain an even temperature, especially at night. Small stacks, such as the above, are unlikely to overheat or ferment too quickly and should result in the production of a comparatively light tobacco.

Larger stacks with a square or rectangular base may be employed. Arrangements must be made when building them to permit the temperature near the centre of the bulk to be taken. This is often accomplished by laying a pipe in the bulk when stacking with one end to the outside and the other one near the centre, in which the thermometer may be placed.

Large stacks generally produce dark-leaved tobacco. The stacks should be made on a wooden floor and it is desirable to have the base raised on legs or bricks to permit a current of air to pass underneath the base.

During fermentation, changes take place, resulting in the development of flavour and aroma in the leaf. The rate of fermentation mainly depends in the amount of moisture in the leaf, this in turn influencing the temperature of the stack. Insufficient moisture causes a low temperature fermentation, whilst excess of moisture will cause a rotting of the leaves.

The temperature must be carefully controlled and should not exceed 120°F. for if it is allowed to become too hot, even with the moisture content normal, black rotting will take place. It should rise gradually to about 114°F. in about a week; to prevent it going higher, the stack should be pulled down, the leaves shaken out and the stack rebuilt. This process must be repeated as often as the

temperature rises to about 114°F. Fermentation will be completed in 5 to 6 weeks. Should the temperature fail to rise at any time during the first few weeks the stack will require rebulking. If the temperature, after the requisite period of fermentation, gradually drops, the bulk may be left until required for sale, but it is desirable that it be carefully watched for a possible further rise in temperature.

Tobacco bulks that fail to rise in temperature during the first few days will require to be pulled down, the leaves spread out and left in a shed with the windows open overnight and again bulked the following morning. The tobacco will probably have taken up sufficient moisture to commence fermentation, subsequent treatment being normal as described above.

Sun - Curing.

This method of curing is used for light tobaccos destined for the manufacture of cigarettes and is practised in many countries. It consists of harvesting the whole plant when about two-thirds of the number of leaves are ripe. The plants are hung by the main stem on to scaffolding in the shade, until the leaves become yellow, after which the poles, with the plants hanging from them, are exposed to the direct rays of the sun.

The tobacco plants must be carried under cover when rain falls and at nights to protect them from the dew; alternatively, the crop might be covered with portable frames carrying "lalang" grass thatch or ataps. Sail cloth is sometimes used for this purpose.

The Chinese method of sun-curing, which is practised on small holdings, has been tried with satisfactory results at the Government Experimental Plantation, Serdang. This method consists of harvesting single mature leaves and laying them flat between two frames tied together and constructed of half-inch bamboo laths; the dimensions of the frames are usually about 5 feet x 3 feet and such frames will only hold about 4 to 5 leaves at one time; the frames containing the leaves are stored overnight in a shed: only small crops can be handled in this manner.

Sun-curing takes 10 to 14 days according to the intensity and amount of sunshine. Care must be taken to dry the leaves thoroughly so as to prevent the growth of fungi during storage. Bulked sun-cured tobacco must be carefully watched to guard against fermentation. The flavour and aroma improve after the leaf has been bulked. For use on a large scale, or for the curing of Virginia leaf, this method cannot be recommended in Malaya, because of the uncertainty of the climate and the comparatively high cost.

No Virginian leaf is at present grown commercially in Malaya, although experimental work is in progress at certain of the Departmental Agricultural Stations. The work at Serdang includes investigation of curing in barns warmed by hot air, since it is certain that artificial methods will be essential for this type of tobacco in the humid climate of Malaya.

Yields.

The returns at the Government Experimental Plantation, Serdang, after calculating the weight of the finished product to be 20 per cent. of the freshly cut leaves, have been exceptionally good and have ranged between 10 to 18 piculs per acre. These figures are the results of well-cared-for crops, grown on small areas, with the addition of cattle and pig manure only.

Normal yields of correctly grown crops on average land should be 8 to 10 piculs of cured leaf per acre.

Table III gives the list of varieties tried at the Government Experimental Plantation, Serdang, during the year 1931, and includes particulars of their period of growth and yields.

Insects and Diseases.

Control measures are given hereunder for the commoner pests and diseases in Malaya.

The tobacco plant is very susceptible to the attacks of insects and diseases from the time the seed is sown until the crop is cured.

The writers wish to record their thanks to Mr. N. C. E. Miller, Assistant Entomologist, for his assistance in checking the section on insects and to Mr. A. Thompson, the Acting Mycologist of the Department of Agriculture, for his assistance with the section on diseases.

Insects*

A small ant, *Solenopsis geminata*, is frequently responsible for carrying away seeds. This ant may be controlled by pouring into the nests a disinfectant or boiling water, or by digging out the nests and destroying the contents. On a small scale the seed may be grown in boxes provided with short legs standing in a receptacle containing water having a film of kerosene.

Leaf-eating caterpillars and grasshoppers should, if possible, be hand-picked and destroyed. In the event of insects becoming too numerous for hand collection, spraying will be necessary. A useful general spray for leaf-eating insects is 1½ lbs. of lead arsenate to 50 gallons of water. As new leaves are formed it may be necessary to repeat the application. Dusting instead of spraying is often practised. For this method, which has proved satisfactory, lead arsenate powder is used, being mixed in the proportions of 4 lbs. lead arsenate to 4 lbs. of dust, wood ashes or air slaked lime. The total quantity is sufficient for 1 acre.

Tobacco Stem-borer.—The caterpillar of the insect *Phthorimea heliopa* often causes serious damage to the tobacco crop, but so far this pest has not been observed at Serdang.

* A fuller description of the insect pests of tobacco recorded in Malaya will appear shortly in this Journal.

TABLE III.
Yields and Periods of growth of varieties of Tobacco grown at
the Government Experimental Plantation, Serdang.

Variety	Class suitable for	Date Sown	Date germinated	Date transplanted	Flowered	Date leaves harvested	Wt. of green leaf from one bed, 4' x 66'	Calculated yield of green leaf per acre in lbs.	Calculated yield of dried tobacco in lbs.
Joyner	...	19.6.31	26.6.31	21. 7.31	14. 9.31	20.11.31	68 lbs.	8,840	1,768
Hickory Prior	...	19.6.31	26.6.31	25. 8.31	10.10.31	27.11.31	92 "	11,960	2,392
White Burley	Pipe	25.7.31	1.8.31	2. 9.31	26.10.31	1.12.31	57 "	7,410	1,482
Dunbara	Cheroots	25.7.31	1.8.31	1. 9.31	14.10.31	1.12.31	52 "	6,760	1,352
Thattayan	"	25.7.31	1.8.31	31. 8.31	28.10.31	11.11.31	92 "	11,960	2,392
466 Burma	"	5.8.31	12.8.31	4. 9.31	14.10.31	30.11.31	52 "	6,760	1,352
Jaffna	"	16.8.31	24.8.31	16. 9.31	20.11.31	16.12.31	60 "	7,800	1,560
Deli	"	16.8.31	24.8.31	21. 9.31	24.11.31	16.12.31	60 "	7,800	1,560
Burmese Havana	"	8.9.31	14.9.31	9.10.31	20.10.31	26.12.31	65 "	8,540	1,690
Shwengyin	"	8.9.31	14.9.31	9.10.31	20.11.31	16.12.31	65 "	8,450	1,690
Bhengi	"	8.9.31	14.9.31	10.10.31	28.11.31	31.12.31	76 "	9,880	1,976

The eggs are laid mostly on the under-surface of the leaves and the newly hatched caterpillars, first mining into the leaf, reach the stem by way of the mid-rib. They pupate sometimes in the mid-rib when the leaves are large but generally inside the stem. Swellings are formed on the stems at the points where the pest is feeding.

Control measures consist in slitting with a clean, sharp knife the swollen portion of the stem and killing the caterpillar or pupa. All badly attacked plants should be burnt and after the harvesting of the crop, old tobacco stumps should be pulled up and destroyed with all other refuse from the recently harvested crop.

Diseases.

Damping-off.—This trouble, which is caused by the attack of a fungus in the seed beds, has been mentioned previously in this article and preventive measures have been suggested.

If young seedlings show signs of root or leaf diseases they should not be used for planting. It is advisable to remove them from the seed bed, along with the immediately adjacent, apparently healthy plants with which they have been in contact. Such plants should always be burnt.

Physiological Diseases.—The physiological distortions of the leaves which may occur when the plants are a few weeks old are usually attributed to deficiency of potash or available nitrogen, e.g. in the case of "frenching"—characterised by the production of narrow, fleshy leaves, from suckers arising in the axils of normal leaves—a dressing of nitrate of potash is an effective remedy.

Mosaic Disease.—This is a virus disease, which can be very infectious. The symptoms of ordinary mosaic are manifested on the leaves which become mottled by varying shades of light and dark green. In some cases, blistering and other malformations may appear. The disease attacks plants at all stages of growth, and can cause a reduction in the quantity and depreciation of the quality of the leaf.

Seedlings showing mosaic symptoms in the seed bed should be removed at once and burnt, care being taken not to handle healthy plants after handling infected plants since the disease is easily transmitted by the hands. Weeds, or plants belonging to the tobacco family (*Solanaceae*), should not be permitted to grow near tobacco plots. Field sanitation involving the destruction by burning of any plants which become infected and the removal and burning of old tobacco stalks is recommended.

Wilt.—This disease is also known as "slime disease". The leaves of affected plants wilt rather suddenly as a result of the plugging of the vascular system of the stem by bacterial slime. The responsible organism is a soil bacterium (*Bacillus solanacearum*) which usually enters the stem through the roots. On cutting across an infected stem, the vascular system is found to be discoloured and in advanced cases a dirty white slime exudes in drops from the surface.

The trouble is not often serious on virgin land, but if tobacco is grown in the same soil continually, the percentage of infection increases each year and may cause considerable reduction in yield.

Crop rotation with non-susceptible crops (*e.g.* maize, beans) is essential, and it is advisable to sterilise the soil of seed beds by heat. This can be done by burning brushwood and grass on top of the soil. Only healthy plants should be used for planting and the roots should be injured as little as possible when transplanting.

Tobacco stems and crop refuse should never be buried on areas on which tobacco is to be grown. All such material should be burnt.

Frog-eye.—This is a disease of the leaves and is caused by a fungus (*Cercospora nicotianae*) which produces pale brown irregular shaped spots on the leaves. The older leaves are usually the first to show the infection. The attack is more severe during rainy weather.

The disease is not easy to control, but it does not, as a rule, do serious damage in the field.

Early removal of the lower infected leaves helps to remove sources of infection and tends to reduce the number of spots on the younger leaves.

AGRICULTURE IN BRUNEI

BY

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The State of Brunei comprises an area of 2,500 square miles and a coast line of about 100 miles.

It lies between latitudes 4°2' N and longitudes 114°7 and 115°22 E. It is bounded on the western side by the State of Sarawak, and on the east by the territory of British North Borneo, and is divided into two parts by the Limbang Division of Sarawak which intrudes through Brunei to the sea at Rangan Slarow and separates the district of Temburong from the remainder of Brunei Territory.

It possesses an equable climate with a rainfall which ranges between 100 and 200 inches for different parts of the State.

It is well watered and traversed by four main river systems, *viz.* the River Brunei, the River Tutong, the River Temburong and the River Belait which give their names to the four principal districts.

The principal town is Brunei, situated 12 miles from the mouth of the Brunei River, consisting mainly of Malay houses built on "nibong" piles in the river, but also including a strip of mainland on which Government buildings, shop houses and private dwellings are erected. The other townships are Tutong and Kuala Belait; developments at the latter township are taking place rapidly as the result of the operations of the British Malaya Petroleum Company.

The country in general consists of level plains alternating with rolling country; at certain points in Temburong, Tutong and Belait hills of some height occur.

The soils of Brunei in the extensive alluvial plain consist of heavy clays and sandy clays; in the hill regions they are more sandy in character. The country is still to a large extent covered in forest.

Agricultural Population.

The population as enumerated at the 1931 census comprised 30,135 persons or 12 per square mile; it is, therefore, still very thinly populated. It comprised approximately 27,000 people of Malay race, 2,700 Chinese with 377 Indians and 60 Europeans.

The Malay races are stated in the census report to be made up approximately as follows :—

Bruneis	Kedayans	Tutongs	Belaits	Dyaks and Muruts
17,000	6,000	2,700	450	750

Of these the Kedayans and the Tutongs are best fitted for agricultural pursuits, being hard working and having a natural bent therefor. The Bruneis are fishermen, metal workers, weavers and so on, but, it is said, are showing an

increasing tendency to betake themselves to agriculture.

There are four European owned rubber estates; two of these are situated in Brunei district and two in Temburong district: the total area under cultivation in rubber on estates is stated to be 4,000 acres, while in addition there are about 5,000 acres under native rubber. The exports of rubber for 1930 were 870 tons and for 1931, 725 tons. For the most part, tapping has ceased on native holdings, though it is still continued on two out of the four European estates.

Apart from the four European estates, the whole of the agriculture in Brunei is in the hands of natives, and with the exception of rubber plantations which, as everywhere else in the Malayan region, has appealed to the natives by reason of the ease of the operations involved and the high returns which the industry formerly yielded, have consisted in the main in rather primitive operations for the production of food crops, particularly rice and sago, together with fruits, vegetables, poultry and meat required for the consumption of the community.

Agricultural Trade.

The exports of the country have comprised in addition to rubber, sago, jungle products, including particularly jelutong and cutch * for the extraction of which a small factory exists in Brunei town, dried fish, brass ware, silver ware, native textiles, together with small quantities of cattle, pigs, poultry and copra.

The value of imports and exports for the past three years have been as follows:—

TABLE I.
Imports and Exports of Brunei.

Year	Imports \$	Exports \$
1929	1,484,293	1,251,335
1930	2,536,422	807,449
1931	2,193,511	501,494

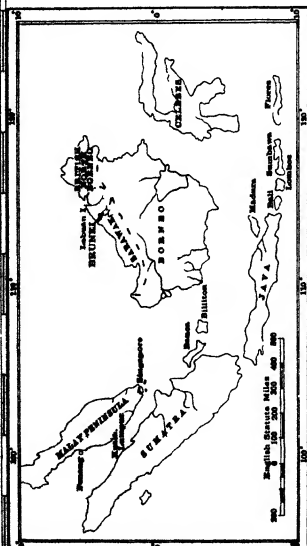
The vast disparity between imports and exports in the two years 1930 and 1931 is due to the operations undertaken by the Malayan Petroleum Company in opening up the oil field at Kuala Belait, and it is indeed fortunate for the State that these developments should have occurred at the present juncture, as they have served to mitigate to a considerable extent the effect in Brunei of the world depression.

It is noteworthy that among the articles imported are included the following which are capable of being produced locally:—

* A tanning material extracted from the bark of the mangrove tree.

SKETCH MAP OF THE STATE OF BRUNEI

Scale 12 Miles to 1 Inch
Miles 12 24



REFERENCE

- Marked Road
- Earth
- Road Along Sand Beach
- State Boundary (assumed)
- District Name
- Residency
- Ry
- European Rubber Estates
- Native Rubber Cultivation
- Native Holdings
- Oil Milling Lands
- Oil Prospecting License
- Oil Prospecting License (Brit. Nat. Pet. Co. Ltd.)

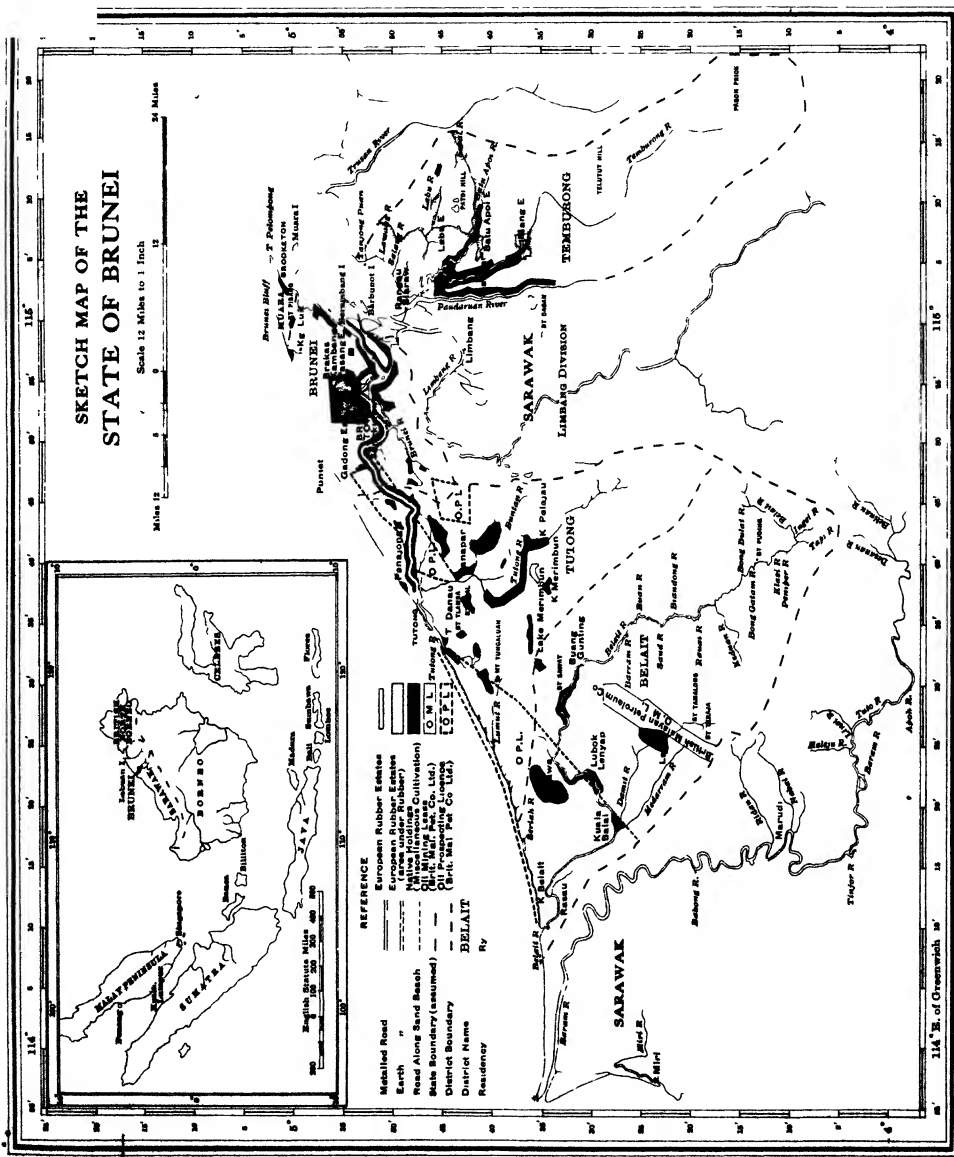


TABLE II.

Imports into Brunei of Certain Agricultural Products.

Product.	Quantity.				Value \$		
	1929	1930	1931	How Stated	1929	1930	1931
Rice	27,754	54,370	30,515	pikuls	199,697	212,772	135,410
Milk	1,834	4,884	2,418	cases	21,642	30,198	26,389
Tobacco	79,841	91,694	80,941	lbs.	125,137	120,536	109,215
Coconut Oil	2,710	2,476	2,287	tons	15,187	12,283	8,710
Coffee	316	388	519	pikuls	14,346	11,848	10,789

The revenue and expenditure of the State for the past three years has been as follows :—

		<i>Revenue</i>	<i>Expenditure</i>
		\$	\$
1929	...	345,290	344,092
1930	...	333,069	379,604
1931	...	342,011	322,791

There is at present a surplus of \$170,737, while the public debt amounts to \$459,750. The principal sources of revenue are Customs, Monopolies and Land Revenue.

Up to the present, there has been no expenditure on agricultural services. It should, however, be noted that the Government has temporarily engaged the part time services of an unemployed Dutch planter who is raising plants for distribution to native cultivators.

Land Alienation.

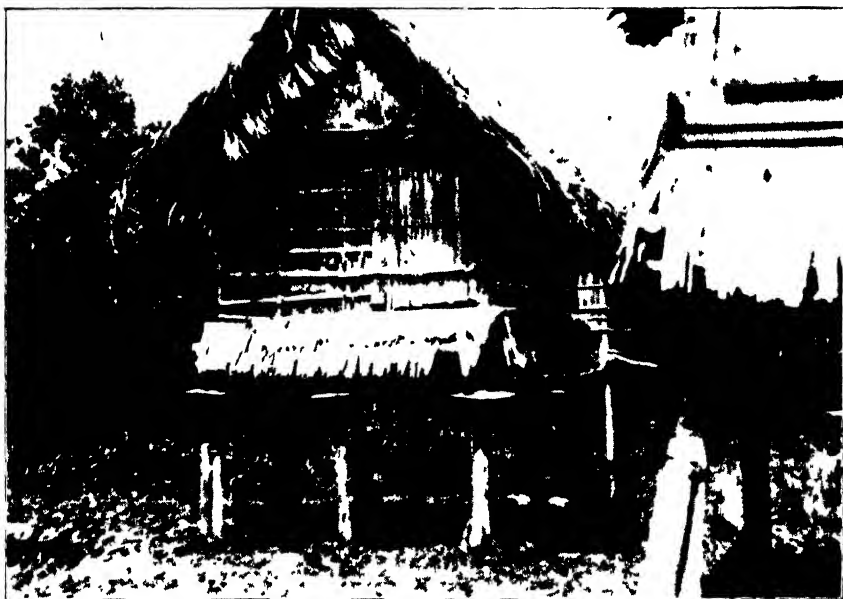
Alienated land at the end of 1931 amounted approximately to 74,900 acres, and there were 4,500 small holdings. Land is alienated by entry in the Land Office register, from which an Extract is issued as title following Malayan practice.

Land that has not been alienated is termed State land, and may be disposed of by the Resident under the Land Code, 1909, the procedure under which follows generally that which obtains in the F.M.S.

There is at present no Survey Department; surveys of alienated land being performed by prismatic compass.

Communications.

Until comparatively recently, communication was entirely by river or by jungle tracks, but latterly a programme of road construction has been embarked on, a road from Brunei to Tutong having been completed. A second from Brunei



A PADI STORE IN BRUNEI
(Note precaution against entry of rats)



A BRUNEI NATIVE HOMESTEAD
 SHOWING PADI STORE IN REAR

to Limbang in Sarawak is now practically complete, a third from Barakas Estate to the Coast is under construction, while there is a fourth from Bangan to Panderuan in Tembarang district; it is understood that the construction of other roads is contemplated in due course.

The effect which the programme of roading is likely to have on the agricultural development of the country is considerable: already there are abundant signs that the system of shifting "ladang" (dry land) cultivation which was formerly universal is tending to become replaced by permanent wet padi cultivation in the areas opened up by the road system, and both on the Tutong road and on the Limbang-Brunei road at Lumpas there are numerous holdings on which the making of permanent "sawah" has made considerable progress.

Rice Cultivation.

The writer was greatly impressed by the possibilities which exist for wet padi cultivation in Brunei; there are in all the localities visited very large tracts of land which appear admirably suited to it, provided they can be opened up; there are also in most localities sufficient areas of "permatang" land to permit of the formation of homesteads.

One is also impressed by the manner in which the Kedayan cultivators had cleared the land for cultivation, there being little signs of jungle stumps and partial cleaning such as is commonly seen in the opening up of new sawah areas. Some of the homesteads seen were also surprisingly good and well kept and might serve as a model for many that are met with in the Malay Peninsula.

It is stated that there are at the present time 7,400 acres under rice cultivation in Brunei of which 3,500 acres are under cultivation in "wet" rice, the remainder being in "dry" rice. The average yield is stated to be about 100 gantangs per acre all round, but from a consideration of the figures for rice imports and of the population it is probable that this may be an underestimation.

Individual yields as high as 500 gantangs per acre are stated to have been recorded, while 350 gantangs per acre are stated to be usual in favoured localities.

Selected strains of seed have been imported for two successive years from the Department of Agriculture, S.S. and F.M.S., and are stated to have given uniformly satisfactory results and to meet with appreciation from the cultivators.

The writer was able to see land preparation in progress at one or two points; methods employed are primitive, but the people themselves—namely Kedayans—are very painstaking and hardworking.

Dry seed beds are sown and the rice transplanted, land being prepared by trampling with buffaloes, the animals being yoked five or six abreast for the purpose. The formation of bunds is performed by means of the "changkol". Ploughing is nowhere practised, it would seem that if more thorough and systematic draining of the land was undertaken the introduction of more economical and efficient methods should be possible.

Future Development of Rice Cultivation.

The developments that are taking place as the result of the opening up of the country by means of new roads are of considerable significance and importance, and provided these developments are fostered and helped there is no reason why the country should not become self-supporting in the matter of rice production in a comparatively short space of time.

But to enable this to be achieved satisfactorily, considerable care and forethought will be necessary; the problems likely to arise will have to be foreseen and provided for and dangers guarded against.

One of the first requisites is that attention should—so far as possible—be concentrated on a small number of areas which should be so situated that considerable expansion is possible at a few parts rather than diffused over a larger number of small areas: this will tend to economy of effort and more efficient work. So far these requirements appear to be largely realised.

The second point is that attention should be given to improvement of agricultural methods including seed supply, cultivation, drainage and irrigation and control of pests. This necessitates some provision for agricultural services, and this must be regarded as essential if progress is to be achieved.

Irrigation for Rice Areas.

The question of the possibility and need for irrigation schemes naturally arises; the rainfall is on the whole heavy and well distributed, but the advantage of having some irrigation water available to supplement rainfall, if need be, is evident: conditions appear to be favourable to small scale irrigation projects which could be undertaken by the people themselves, and this question, as well as that of improving the drainage of the fields, will have to be kept in view.

Regulation of Rice Planting

A further point that will probably require attention is the need for provision that operations in relation to padi planting can, if necessary, be capable of official regulation, while powers will also be required to deal with possible outbreaks of disease. Titles for padi lands are at present issued with a clause providing for resumption of the land if unplanted for three years.

Economics of Rice Cultivation.

The economic side of rice cultivation will also require attention, and in this connection the possibility of the provision of some assistance to intending padi planters in the clearing of the lands should be considered.

A further point is the question of marketing of surplus padi and rice so soon as the production begins to exceed the consumption powers of the producers themselves, and the allied question of indebtedness.

Probably the most effective way to approach this and the allied problem of

indebtedness may be found to be the establishment of small supervised marketing groups and the provision, if need be, of Government controlled buying and selling agencies; if these are established the question of linking up the provision of credit therewith is an obvious further step.

It is understood that the Resident proposes, during the coming season, to establish buying centres for rice and padi in the three principal urban areas.

Rice is at present prepared in the native homesteads by the usual primitive process of pounding in a mortar by hand. The samples of prepared rice seen by the writer were very indifferent in quality with much broken grain. So soon as rice in commercial quantities becomes available for sale, the question of milling is bound to arise.

Mechanised Rice Cultivation.

A factor in the present situation is the interest which is being taken in rice cultivated by certain of the estates. Two estates are taking steps to induce Malay cultivators to take up rice cultivation on lands in their concessions with the object of attaching labour to the estates which will continue to be available if and when conditions in the rubber industry improve, and on one of these estates a considerable area has been cleared by Malay settlers for the purpose.

It is understood that the manager of the other estate is considering the question of undertaking mechanical rice cultivation in uncleared areas in the estate.

The idea is interesting and is no doubt the outcome of tendencies in the same direction which are said to be in evidence in Sarawak; in Limbang which adjoins and bisects Brunei, a Japanese company has, it is understood, obtained a concession from the Sarawak Government for the purpose of undertaking large scale mechanised rice cultivation, while in other parts of Sarawak one or more groups of Chinese are stated to have taken up land with a similar object in view. If these ventures show promise, the possibility of similar developments in Brunei may be expected to arise.

Padi cultivation has been considered at some length, as it appears to be the agricultural question of outstanding importance in Brunei at present, and the one on which the attention of Government should chiefly be focussed with a view to rendering the country independent of imported padi, but this does not preclude attention to other crops.

Miscellaneous Crops.

Obviously the planting of coconuts is capable of marked extension, while coffee also is capable of considerable expansion with a view to meeting local needs.

Attention should also be paid to the probability of a steadily increasing demand for meat, poultry, eggs, fresh vegetables and fruit as the development of the oil fields proceeds, and here Brunei and Labuan can very well compete.

Groundnuts, arecanuts and tobacco also are worthy of attention. There also appears to be a marked shortage of buffaloes, and attention to this point also would serve a useful purpose, while the improvement of poultry is also an important line.

In relation to the possibility of extension of estate agriculture, one is struck by the probable suitability of much of the undulating country for oil palm cultivation, and this view is strengthened by the fact since learned that an estate of about 1,200 acres under this crop has been established in Sarawak and is stated to be showing considerable promise.

The possibility in this direction in Brunei might well be tested out by experimental plantings at one or two points.

Organisation of Agricultural Services.

But for these developments to be achieved, the establishment of agricultural services seems essential; these should include the opening up of test and demonstration plots and plant distributing centres, and definite efforts in certain other directions, namely, the holding of periodical shows of agricultural produce, the organising of regional small-holding competitions, and the establishment of school gardens in connection with the vernacular schools of which there are now 10 in operation.

It is also suggested that attention might be directed to the feasibility of establishing district agricultural committees with a view to assisting developments on the lines adumbrated in one of the resolutions of the recent Inter-departmental Agricultural Conference.

It is probable that moderate expenditure in establishing services with these objects in view would fully recoup itself in due course.



DERRIS ELLIPTICA.

Showing immature pods.

Inset — mature pod and seeds (all reduced).

SEEDING OF DERRIS ELLIPTICA

BY

J. N. MILSUM,

Acting Agriculturist.

Under ordinary conditions of cultivation in Malaya, tuba (*Derris elliptica*, Benth.) rarely forms seed pods. Propagation is exclusively asexual and this fact may be a contributory cause of the failure to produce seeds. A further reason is that the plants are normally lifted from the soil when about two years old for the purpose of harvesting the roots. However, under local conditions, pollination is rarely accomplished and although numerous plants have been examined it is only recently that pods have been observed and seeds obtained.

During the middle of March 1931, several immature pods were noticed in a 4 acre block of two year old tuba under cultivation at the Government Experimental Plantation, Serdang. A number of pods failed to mature, but upon carefully examining the whole stand of plants in the following August, six pods containing several seeds were collected. A large plant climbing over a dead tree on land adjoining the Demonstration Station, at Kuala Lipis, Pahang, set a considerable number of pods estimated at about a thousand. These matured at the end of August, 1931, and provided the material for subsequent investigations.

The pods averaged 2.5 ins. to 1.75 ins. long, 1 in. broad and 2 ins. thick. Colour when mature, olive-brown turning dark brown. The majority of pods were one-seeded, while others contained two or, in several cases, three seeds. Actually 680 pods were examined and these were found to contain 985 seeds. The seeds are joined to the upper suture of the pods. Length of seed .5 in., breadth .3 in., flattened .15 in. thick; colour coffee-brown, deepening upon removal from the pod. Approximately 100 seeds weigh one ounce.

The seeds were sown in boxes of prepared soil and germination commenced ten days later, continuing for six weeks. A total of 25 per cent. germination only was obtained, since there were many unsound seeds sown. The seedlings were transplanted into bamboo joints and grown until sufficiently large to plant out in the field. The plants were examined a year after the seeds were sown and found to be making good growth. The majority were over two feet high with stems a quarter of an inch or more in diameter.

Since the propagation of *D. elliptica* is so readily undertaken from cuttings of portions of the stem, there is normally little necessity to raise plants from seeds. Moreover, owing to the rarity of fruiting under ordinary plantation conditions in Malaya, it is a matter of considerable difficulty to obtain seeds in any quantity. However, in view of present knowledge regarding the improvement of yield of the essential product in tropical crops as a result of selection, e.g. Cinchona, the possibility of developing clones of high toxic content is widened by the discovery that under suitable conditions, fertile seed of derris is produced.

The writer is indebted to Mr. J. Fairweather, Agricultural Field Officer, for forwarding the material from Kuala Lipis.

SAN BLAS COCONUTS IN MALAYA

BY

A. C. SMITH.

San Blas coconuts having been reported to be very high yielders, seed nuts were obtained from Panama in 1920/21 with a view to testing them in the Lower Perak District.

Some 200 seed nuts in all passed through the hands of the writer. Despite delays in transit, germination on the whole was good — about 80 per cent. — from which 150 seedlings were planted out. These were planted in alternate rows with the ordinary "tall" variety, care being taken that exactly similar conditions as regards soil and drainage applied in each case.

The first 50 were planted on low lying peaty soil, drained every fourth row (120 feet) by a 4 feet x 4 feet drain, with a 2 feet x 2 feet scupper drain in every row. The second 50 were planted in a block on and adjacent to the well known "sand ridge" which runs through the Bagan Datoh District from the Perak River to the Bernam River. The ridge outcrops at the spot to three or four feet above normal soil level, is almost pure white shell, and thus extremely well drained at all seasons. The third 50 were planted on a belt of very heavy yellow clay, also at a comparatively high level, with a water table of 3 to 3½ feet.

Initial growth in the first two batches was good, rather superior to that of the ordinary tall. Flowering was also slightly earlier. The third lot have all along been much behind the tall. This may be due to the heavy soil, or to the fact that they were the last to germinate, as it is frequently observed in estate practice with the ordinary tall that slow germination usually results in an inferior palm. Probably the poor growth is due to a combination of both factors.

The palm differs markedly in many characteristics from the tall. In general appearance it may be roughly described as midway between that and the green dwarf. The stem is slighter, measurements of 20 palms of each variety at six feet gave an average girth of 30.3 inches San Blas and 38.5 inches tall. From ground level to first leaf the San Blas averages between five and six feet shorter. On the other hand, the leaf is longer as is also the spadix. Twenty leaves averaged 23.1 feet in length compared with 21.2 feet in the tall, and 20 spathes averaged 48 inches against 38 inches. As will be seen from the illustrations, the palm can be readily distinguished from the tall apart from the difference in height. The chief characteristic on casual observation is the very open crown and the large number of leaves hanging more or less vertically. It is not exceptional to observe 12 green leaves hanging down the stem at almost 180 degrees. The spathes are much more open with longer branchlets and the female flower set further out from the spathe stem than is usual in the tall. It is not exceptional to see as many as three fertilised female flowers on a single branchlet.

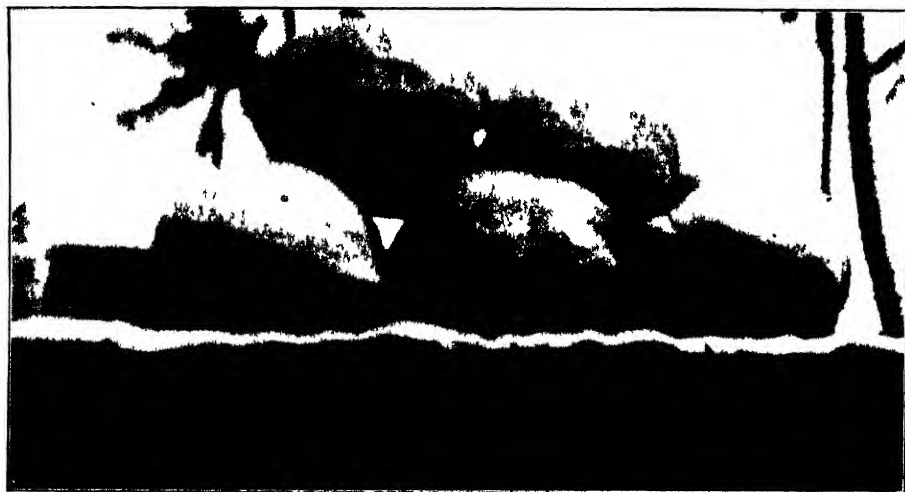
COMPARISON OF PALMS ON ADJACENT BLOCKS



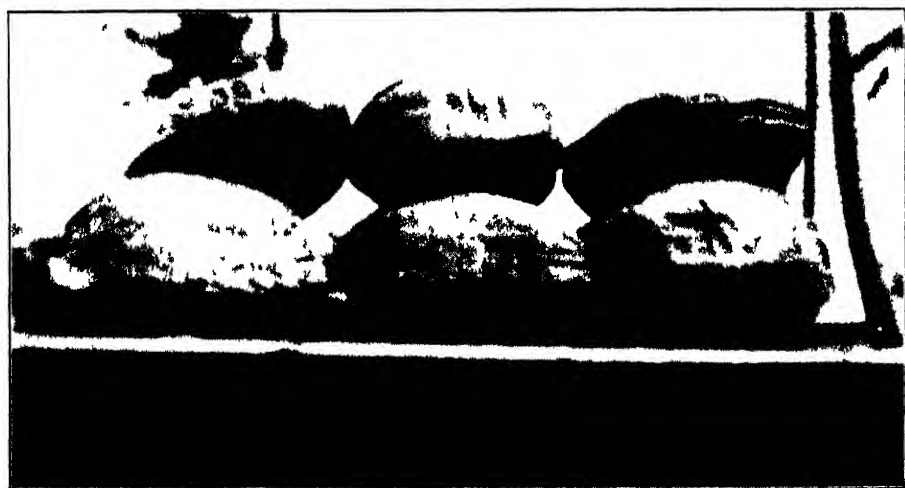
TALL PALMS 1920 PLANTING.



SAN BLAS PALMS 1920 PLANTING.



NUTS FROM TALL PALMS.



SAN BLAS NUTS FROM NEXT ROW TO TALLS SHOWN ABOVE.

The first flowering and nut setting was distinctly promising. Spathes carrying from 12 to 16 three-quarter developed nuts were frequently observed. This early promise, however, did not come to fruition; practically all the nuts fell before ripening commenced and there has been no improvement in this respect up to date. A count of the same 20 palms of each variety showed in the San Blas an average of 21 fertilised female flower, 32 nuts more or less fully developed but green, and slightly under 2 ripe nuts. The count for the talls showed 14 fertilised flowers, 21 fully developed nuts, and 9 ripe. These figures confirm the first impressions gained, that the San Blas is a more prolific bearer as far as actual number of fruits set is concerned. Why the premature nut-fall occurs is difficult to determine. That the cause is primarily physiological cannot be doubted. With the longer and more open spadix the bunch of 12—15 nuts appear to be at least as comfortably seated as any normal bunch on the tall variety, and there is nothing to indicate that excessive "squeeze-off" will occur. There is certainly lack of support owing to the drooping leaves, but it is rarely noticed that the spadix has fallen, or even become partly detached, at least not until the nuts are in a very forward stage of development. A peculiar feature is that even with nuts which ripen on the palm the husk invariably shrivels. Frequently cracks are observed and the general appearance is similar to nuts which have prematurely fallen from the tall variety and have ripened (or browned) on the ground, or like the more or less empty husk one sees on palms which have been abandoned in swamp or secondary jungle growth. This would indicate that the premature nut-fall is more due to physiological causes than to mechanical. A possible reason is that environmental conditions on the West Coast clays, with a high water-table, are quite unsuited to this variety, differing greatly as they must from the sandy seashore environment of their habitat.

The fruits differ greatly from those of the tall. In addition to the shrivelled husk mentioned above, they are almost without exception elongated, as will be seen from the illustration. The nut proper follows closely the shape of the whole fruit. Ten fruits from a row of San Blas and ten from the adjoining row of talls were collected for comparative purposes, one from each palm. All were as nearly as possible in the same state of ripeness and were carefully stored under identical conditions for three weeks prior to weighing and measuring. All were then perfectly ripe, and germination, except in the case of No. 3 tall, was nil. Measurements round each fruit longitudinally gave an average of 70.7 cm. San Blas and 69.6 cm. tall. The average girths were 57.5 and 63.5 cm. respectively. This emphasizes the ovoidal character of the San Blas. Another feature of these nuts is the very high husk percentage compared with the tall. This amounts to 43.7 per cent. of the whole fruit compared with 26.1 per cent. in the tall. These points are clarified by the following table.

Comparison of the San Blas coconut with the ordinary "tall" variety.

Palm No.	San Blas.				Tall.			
	Weight Grammes.			Thickness of meat mm.	Weight Grammes			Thickness of meat mm.
	Fruit.	Husk.	Wet Meat.		Fruits.	Husk.	Wet Meat.	
1.	1289	554	368	12.7	1770	390	554	11.1
2.	1261	512	335	13.5	1730	454	577	14.3
3	2042	851	540	15.1	1873	794	454	12.0
4	1872	821	381	12.7	1575	440	482	15.1
5.	1545	921	285	11.9	1460	350	468	13.6
6	1375	667	310	11.1	1600	386	427	11.1
7	1488	510	468	11.9	1475	347	460	11.9
8	1248	567	327	11.0	2224	595	654	14.3
9	1716	753	454	11.9	2015	335	456	15.5
10.	1448	527	397	12.4	1262	350	368	12.4
Average	1528	668	386	12.4	1698	441	490	13.1
% whole nut.		43.72	25.26			26.15	28.85	

It will be noted that in every San Blas nut husk far outweighs meat, whereas the reverse is the case with the tall except No. 3. This nut had a 3 inch "apple", a perforated eye, with the meat partially rotten.

Taking the dry copra content as 53 per cent. of the wet meat it would require 293 San Blas nuts per picul of copra against 232 of the tall. This latter figure is within one nut of a recent large scale test to determine the number of nuts required per picul from the block in question; the nuts under test did not include any San Blas. From casual observation one would fix the number of San Blas required at about 300 per picul.

Conclusions.

Although the San Blas coconut has the reputation in Central America of being an extremely prolific yielder, it would appear that it is not suited to the heavy alluvial clays of the West Coast of Malaya. Both in number of nuts harvested per palm per annum, and in copra content, it is far below the ordinary Malayan tall variety.

Abstract.

THE PRODUCTION OF ESTATE RUBBER IN NETHERLANDS INDIA DURING THE FIRST HALF YEAR 1932.

Abstract from Landbouw, Economisch Weekblad, 21 October, 1932.

On the 30th of June 1932, 255,904 acres of estate rubber were out of tapping; this is equivalent to 27 per cent. of the potentially productive area in existence on 31st December, 1932.

The yield per acre per month of the productive area increased considerably, rising from 32.90 pounds in December 1931, to 36.92 pounds in June 1932.

In 1931 production during the first half year was 81,863 metric tons; in 1932 during the same period, it was 79,982 metric tons. Production during the second half of 1932 is expected to be much smaller and the total 1932 production will probably not exceed 149,331 metric tons, equivalent to 78.3 per cent. of a potential production of 190,636 metric tons; whereas for 1931 it was 165,799 tons, equivalent to 90.9 per cent. of a potential production of 182,338 metric tons.

Comparison of the first halves of the years 1931 and 1932 shows a decrease of 27 per cent. of productive area and a decrease of only 2.3 per cent. of actual production. This is due to a combination of contributory causes which it would be hard to estimate at their true value separately. The decrease of area in tapping has of course been gradual. The least productive fields have been the first to be taken out of tapping. Young fields that have reached tappable age have not been put into tapping, as such practice would not now be economically sound. More drastic tapping systems are, in many cases, operative at the present time on the generally more highly productive areas which are still being tapped. The general policy of those estates that have not yet closed down is to reduce the cost per pound by confining their operations to the most remunerative fields, while reducing expenditure—general as well as specific—to the absolute minimum. This policy has, on those estates that are still tapping, increased the average yield per month per acre from 37.72 pounds in January 1932 to 39.33 pounds in June 1932.

The total area newly taken into tapping since 31st December, 1931, was 17,483 acres on the estates which were still in tapping on 30th June, 1932, whereas on 9,768 acres of the above estates tapping was stopped.

On the estates on which the area in tapping remained unaltered, production increased by an average of 3 per cent. for the whole of the Netherlands Indies, but in Java and Madura alone the average was 8.5 per cent., the most probable cause of this increase being the re-introduction of more drastic tapping systems.

On some estates, part of the tappable area is now being tapped heavily. In January 1932 this was the practice on about one-third of their total area,

i.e. on 22,457 acres out of 72,812 acres. In that month the average production of these estates was 35.67 pounds. In June the figures for these same estates were respectively 13,613 acres, 39,497 acres and 38.70 pounds. If a total is taken of all estates on which, in June 1932, a part of the area was being tapped heavily, the figures are respectively 21,978 acres, 52,819 acres and 39.86 pounds. This yield figure is only little more than that of the average yield of all estates still working on 30th June, 1932, which was 39.33 pounds per acre.

In 1926, 81,204 acres were planted. Under normal conditions the whole of this area would have been put into tapping during the first half of 1932, whereas, considerably less than half of this new area was actually being tapped on 30th June 1932.

MALAYAN AGRICULTURAL EXPORTS, SEPTEMBER, 1932.

PRODUCT,	NET EXPORT IN TONS.				
	Year 1931	Jan-Sept. 1931	Jan-Sept. 1932	September 1931	September 1932
Arecanuts ...	19,266	14,794	15,441	1,718	1,826
Coconuts fresh ...	10,468	6,165	89,970†	840	6,726†
Coconut oil ...	9,909	7,412	8,132	772	812
Copra ...	100,809	70,828	65,951	10,054	10,772
Gambier, all kinds ...	2,563	1,924	2,404	160	301
Palm kernels ...	726	411	843	87	91
Palm oil ...	4,574	2,754	5,398	440	851
Pineapples canned ...	59,457	47,116	54,464	1,782	3,735
Rubber ...	434,857	318,928	305,511	36,833	33,315
Sago — flour ...	5,608	1,999	6,562	538	1,336
" — pearl ...	2,429	1,608	2,136	200	248
" — raw ...	2,904*	1,451*	3,028*	311*	332*
Tapioca — fresh ...	9,742	7,699	7,193	679	668
" — flour ...	491*	109*	191*	85*	1*
" — pearl ...	19,806	14,322	15,371	1,568	1,459
Tuba root ...	74	44‡	98	3‡	15

† '000 in number.

* net imports.

Reviews.

Insects of Coconuts in Malaya.

By G. H. Corbett. *Department of Agriculture, F.M.S. and S.S. Special Bulletin, General Series No. 10, 106 pp. 19 plates. Price \$1.50 (interleaved \$2) post free.*

The planter frequently experiences some difficulty in using a scientific reference book by reason of lack of knowledge of the system of classification employed and the large number of technical expressions and words used therein.

On the other hand, the so-called popular books of reference on scientific subjects are equally difficult to use, because of the lack of method of presentation.

It is obvious that no reference book on such a subject, for instance, as entomology, can be really useful without following the recognised system of classification of insects, but it should not be beyond the wit of man so to modify the system to present needs, and to avoid or explain fully any technicalities, as to render the book intelligible to the general reader.

The Bulletin under review is a successful attempt to supply to the coconut planter a book of reference concerning the insect pests of coconuts.

In order to make the scheme of this work clearly understood, the first four pages are devoted to a simple exposition of the characteristics of insects upon which the classification is based. The following five pages contain a key to the insect pests of coconuts, with page reference numbers to the full accounts contained in the body of the book.

A glossary of entomological terms is added which will enlighten the reader on the meaning of terms which, although perhaps in every-day use amongst entomologists, are not generally understood by the uninitiated.

With a little practice, it should be a simple matter to identify any of the, at present, known insect pests of coconuts and to obtain from this book a complete account of the life history of a pest, and methods recommended for its control.

The illustrations, two of which are in colours, are excellent and should prove a great aid to the reader.

While this book is concerned with the insect pests of coconuts observed in Malaya, it is probable that it will be of almost equal value to coconut planters in other countries. A most comprehensive account is given of the major and minor pests of the coconut palm and this work may therefore be recommended as deserving the most careful attention of planters to whom it should prove of great utility.

D. H. G.

The Export Crops of the Netherlands East Indies in 1931.*

Bulletin No. 104 of the Central Bureau of Statistics, Department of Agriculture, Industry and Commerce, Buitenzorg, September, 1932, pp 220, Price 6 shillings.

Comprehensive reviews of the export crops of Netherlands India in 1929 and 1930 will be found in previous numbers of the *Malayan Agricultural Journal*.* In these reviews, it was shown that Netherlands India is an exporter of a wide range of tropical agricultural produce. The 1931 report proves that the country has fully maintained its position in this respect. Of total world exports in 1930, the Netherlands Indies supplied the following percentages: Cinchona 94, kapok 73, pepper 69, rubber 35, copra 29, agava 22, tea 17 and sugar 10.

In 1931, production and exports were well maintained for most products, although, as was to be expected, the export values declined considerably. The total export value of agricultural products in 1931 amounted to 507 million guilders as compared with 859 millions in 1930 and 1083 millions in 1929. Exports of native production amounted to about one-third of the total.

Production of the principal native foodstuffs—rice and maize—shew a slight decline over the figures for 1930, as does also tapioca. It must be remembered, however, that the Javanese native has for many years produced a very large proportion of his requirements of foodstuffs, while the number of export crops grown by him renders him much more independent of price fluctuations and slumps than is the case with the native in Malaya, who is more dependant on imported foodstuffs and who has a smaller range of agricultural products to which he can turn to provide himself with money. The effect of a low price for the export of food products probably is that the Javanese native, while ensuring his own supplies, is less inclined to cultivate an area sufficient to enable him to have an exportable surplus.

This statistical publication gives clearly the position of the Netherlands Indian agricultural exports for the past five years. While the explanatory sections are in the Dutch language, all table headings and sub-headings of tables are in both Dutch and English so that the English reader, without a knowledge of the Dutch language, may easily obtain from this record the salient points regarding the production and exports of agricultural crops from this most important world producer.

D. H. G.

* A review of the 1930 Export Crops (Bulletin No 97) was published in the *Malayan Agricultural Journal*, Vol. XIX, No 12, December 1931

Miscellaneous Article.

CONDITIONS ON SMALL RUBBER HOLDINGS IN MALAYA.

Third Quarter 1932.

Rainfall.

In July, throughout the greater part of the Peninsula the weather was dry, with the exception of northern Kedah, where rain was well distributed: in the Seremban and Port Dickson Districts of the Negri Sembilan and in parts of Johore and Singapore, the weather was showery.

During the first half of August the rainfall was very slight while wet weather was general in the second half of the month, with the exception of Kedah, Pahang and the Tampin District of the Negri Sembilan, where the weather throughout the month remained dry. Similar conditions obtained during September, when again the first half of the month was dry in most localities and the second half showery. In Penang and Province Wellesley, however, the whole month was abnormally wet, 8 inches of rain falling in 48 hours on the 22nd. and 23rd. causing floods in many areas; the Krian District of Perak also experienced very heavy rain on the same date.

Prices.

A table is appended in which is shown the range of prices for small-holders' rubber among local dealers, together with the average monthly Singapore price for standard sheet and the prices quoted at the end of the month by the large dealers, which are included for the purpose of comparison with these local dealers' figures. All quotations are given in Straits dollars and cents for the price per picul i.e. 133½ lbs.

It should be added that these quotations show the range of prices over a large number of buying centres, in many of which such factors as transport and local competition necessarily affect the prices paid to the small producer.

Tapping.

The slight rise in the market price of this commodity which occurred in August, produced an immediate reaction among a large number of Malay-owned small holdings throughout the Peninsula which had previously been rested, causing their owners to renew tapping work. The District of Johore Bahru was the sole exception to this, as report states that a resumption of tapping was not general in this District in areas which had been left untapped for a considerable period. It is reported from the Negri Sembilan that the area out of tapping at the end of the quarter was 12,500 acres as compared to 20,000 acres at the end of the previous quarter; this figure, it should be added, applied only to Malay-owned holdings up to about 15 acres in extent.

The period of comparative idleness in the padi fields, between transplanting and ripening, which occurred in many districts during the quarter, has also doubtless been a contributive factor to this increase in tapping, as it has caused the release of much labour hitherto absorbed by the work of padi planting.

There has been notably less response to the enhanced price of rubber among the Chinese and Chettiar-owned holdings of larger area, only a minority of which resumed tapping operations. In parts of Selangor, several such holdings of larger area which had been reopened during August, were rested again as soon as the price of rubber dropped to below \$12 per picul.

There does not appear to have been any noticeable increase in the rate of excision during the period of improved prices, no cases of twice daily tapping or a multiplicity of new cuts on the trees have been observed; early morning tapping by torch light has still been noticed in some of the Districts where this had become a common practice.

From road-side observations while travelling between Kuala Lumpur and Taiping during the early part of September, the writer noticed that in most instances where trees had recently been newly opened, the tendency was to tap at within from two to four feet from the ground over old renewed bark, rather than to open up virgin bark, wherever any such existed, higher up the trunk. There was quite noticeable evidence of selective tapping, more especially in the Chinese-owned holdings of slightly larger area in the Kinta District of Perak, where many trees were left resting.

Although it would appear from superficial road-side observation, that the number of holdings in tapping had decreased again slightly towards the end of the period under review, at the same time, by far the majority of the Malay-owned holdings of small area, which had recently resumed tapping, have not again discontinued it owing to the later set back of the market, but appear to be carrying on under the impulse of a certain optimism.

Bark Consumption Records.—The investigations of the rate of bark consumption, bark reserves and yields of rubber on ninety small holdings throughout the Peninsula are being continued: on a total of forty-one of these holdings the twelve consecutive monthly records have been received. Out of the ninety holdings, fifteen had temporarily discontinued tapping operations during the period of investigation, six of which resumed work during the current quarter. Whenever possible, further measurements will be taken on these holdings until twelve month's records are obtained. Since it was found impossible to commence these observations simultaneously throughout all the States, a further forty-nine series of records remain to be completed, the last of which will not be received until March 1933.

Postponement or acceleration of bringing young rubber into tapping.—A report from Johore states that changes in market conditions have not led to the opening up of any of the young rubber still preserved intact, which in more prosperous periods would have already been considered suitable for tapping. One is inclined to believe that, generally speaking, the above might apply equally

to conditions prevalent in almost every part of the country.

Disease.

Mouldy Rot.—An increase in the incidence of this disease, concurrent with the wetter weather towards the end of the quarter, was reported from almost every District in which this disease has already established itself. Reluctance to enforce too rigorously the regulation procedure for its treatment among the impoverished small-holders has led, of necessity, to the spread of mouldy rot disease in some areas.

Pink Disease.—Slight outbreaks of this disease were found in a few localities in Kedah, Pahang, Selangor and southern Perak, but in each case little or no damage was incurred, the attack being speedily and adequately controlled.

Root Diseases.—There has been nothing worthy of comment to add with regard to root diseases during this quarter.

Oidium Heveae.—This disease has been observed to occur in a mild degree over wide areas in the Negri Sembilan, although its effect has been almost negligible.

Grades of Rubber Made.

The small-holder, in this as in the previous quarters of 1932, still favours the preparation of unsmoked sheet, the minimum time being allowed to elapse between its manufacture and sale. It is this urgency for ready cash which has doubtless led to the practise, in one area in the Muar District of Johore, of selling latex at 1 cent per kati (1½ lbs.) to the local Chinese dealers who themselves prepare sheet from it. The output of unsmoked sheet was 80 per cent. in Perak Central, and 75 per cent. in the Negri Sembilan.

The manufacture of slab rubber is now practically confined to the Krian and Taiping Districts of north Perak; its preparation in the coastal Districts of Selangor has almost entirely ceased.

Tendency to abandon Rubber Cultivation for Alternatives.

The cutting out of a few small areas of rubber in order to make room for the development of other standing crops such as fruit trees and coconuts, has been observed for the first time in the Muar District of Johore and in a part of the Dindings. At Bukit Chenggang in Kuala Langat, Selangor, an area of one hundred acres of two to three year old Chinese-owned rubber has been cut out in order to make room for the planting of pineapples.

The continued felling of a few rubber trees in isolated instances has been observed in other parts of Selangor and in Perak, Kedah and the Negri Sembilan.

It should be emphasized that in spite of the fact that in the reports on each preceding quarter of 1932, mention has been made of the cutting down of small numbers of rubber trees, with very few exceptions, it has only been observed to occur either among trees of poor growth and yield, trees interplanted with

coconuts or fruit, or in order to make room for small patches of food crops in localities where no other land is available to the small-holders for the planting of such crops. In view of the present extremely small scale on which such excision has been observed, it is unlikely to have become a factor which will in any way influence the output of rubber in the near future.

Figures of planting distances have been received from the Agricultural Field Officer, Pahang; the measurements were made on a total of 360 small holdings distributed throughout the State, a summary of which is as follows:—

Planting distances		Stand per acre		Percentage of total 360 holdings observed.	
From 8 x 8 feet to 10 x 10 feet	From 681 to 436 trees	3			
10 x 10 " " 13 x 13 "	436 " 258 "	20			
13 x 13 " " 15 x 15 "	258 " 194 "	21.6			
15 x 15 " " 18 x 18 "	194 " 134 "	36			
18 x 18 " " 20 x 18 "	134 " 121 "	9			
20 x 18 " " 20 x 20 "	121 " 108 "	8			
20 x 20 " " 23 x 23 "	108 " 82 "	2.4			

Table of Rubber Prices.

3rd Quarter 1932.

	Singapore Smallholder's Average	Singapore for smallholder's end of month	Penang for smallholder's rubber	Kedah	Province Wellesley	Perak	Selangor	Negri Sembilan	Malacca	Pahang	Johore
JULY											
Smoked sheet	7.18	7.30	—	4.50-7.50	5-6.50	3.90-7	4.90-7.60	4.50-9	5-7	4-6.60	4-7
Unsmoked sheet.		6.50	4.50-5.50	—	4.80-5.75	3-6	3.80-5	3-7.50	4-5.50	3.75-5.90	4-6.50
Scrap		3	—	—	1.80-3	1-4	1-2.50	1-2.50	2-3	1-2.80	1-3
AUGUST											
Smoked sheet	9.80	9.20	—	5.30-8.10	7-10.50	6-10	7-9.50	5.50-11	7-10	6.50-9.30	5-9.50
Unsmoked sheet		7.70	7.80-8.60	4.60-7	6-9	5-9	6-8	4.40-9	5-9	5.50-8.20	5.50-8.50
Scrap		3	4-5.50	3-4.50	2-5	1-5.50	2.50-4	1.50-4.50	2-5	2-4.70	1-4.50
SEPTEMBER											
Smoked sheet.	11.17	9.75	—	10-12	8.50-13.20	8-12.50	8-12	8-13	9-11	7.50-12.50	7-12.60
Unsmoked sheet.		8.50	7-8.13	8.50-10.80	7.50-13	6-11.50	7-10.50	6.50-12	7-9.50	6-11.90	6.50-12
Scrap		3.40	5-6	4.35-6	3-6	1-6	1-4	2-6	3-4	2.50-6	2-6

Departmental.

FROM THE DISTRICTS.

The Weather.

The weather during October was wet with strong winds in most parts of the Peninsula. An unusually heavy rainfall for this month with attendant floods was experienced in the Settlement of Penang, north Perak and Selangor. On the east coast of Pahang, however, the rainfall was lower than it was inland, while the eastern side of the Negri Sembilan and Port Dickson District, together with Kluang and Kukub areas in Johore, experienced fairly dry weather with some heavy showers; in Singapore island there were high winds but little rain.

Remarks on Crops.

Rubber.—The price of rubber remained about the same as that ruling during the latter part of September, but showed a decline on the average figure for that month. Price ranges for rubber produced on small holdings were: for smoked sheet \$6.00 to \$11.50, for unsmoked sheet \$4.00 to \$10.50 and for lower grades \$1.00 to \$6.00 per picul. In Singapore the corresponding average prices were \$9.30, \$8.15 and \$3.00 per picul.

In spite of this decline the general tendency has been for tapping to be undertaken on a larger proportion of small holdings, owing to the completion of padi planting operations in many Districts. Rain in the mornings, however, interfered with tapping on several days during the month in many parts of the country.

Mouldy Rot became very prevalent and difficult to control, while Pink Disease also reappeared in south Perak.

Padi.—The price of padi remained virtually unchanged, ranging from about 6½ to 15 cents per gantang in different parts of the country, and averaging about 9 cents per gantang, though the price at the Government mill at Bagan Serai was \$1.80 per picul or about 7 cents per gantang.

Lack of sufficient water in much of the coastal area and on the higher land in the interior of Kelantan still delayed transplanting. The seedlings in the nurseries which were badly damaged by drought were recovering, but will take a considerable time to become established after transplanting, so that much of the crop will be late.

Planting was practically completed in Kedah, the Settlement of Penang, and central Perak and was progressing well in north Perak and the coast of Malacca. In Krian the south eastern portion has a well established crop which gives promise of a good harvest. In the north western area, water shortage has resulted in irregular planting which will probably not be finally completed before the end of November and is likely therefore to lead to a late harvest in wet weather.

In Kuala Selangor District, more especially in the new areas, clearing work continued and nurseries were sown, but the latter were rather severely damaged by rats which were numerous and difficult to control owing to the presence of much timber on the land.

The crop in Pahang was promising and harvesting had commenced in a few places. Much of the crop should be safely reaped before there is danger of damage by floods.

In Johore the harvest was completed in Batu Pahat District and was in progress in several other places. Rats, birds and the padi-fly, *Leptocorisa acuta*, did some damage.

The Department of Drainage and Irrigation has, during the year, been carrying out a programme for the examination of several potential areas of padi land in the various States and Settlements with a view to the possibilities of providing water supplies and drainage. Such areas are also being examined by officers of the Department of Agriculture who take soil samples for analysis in order to ascertain if the land is suitable for padi planting. During October samples were obtained from the Merlimau Forest Reserve on the boundary of Malacca and Johore. Arrangements were also made for obtaining samples from a considerable area along the Triang river near the Negri Sembilan boundary in Pahang, from Serandu near the town of Pekan on the east coast, from the Duyong area in Malacca and from the Ayer Hitam area in Johore.

The revised scheme which has been approved for draining the Bachang and Tanjong Minyak swamps near Malacca town will add about 3,000 acres to the available padi land, besides improving an undetermined area of existing padi fields.

Coconuts.—The yields of nuts were reported to have decreased considerably in Kelantan, the Settlement of Penang, Perak and Selangor. This decrease is probably seasonal.

The export of nuts from Temerloh to Kuala Lipis in Pahang, referred to last month, has continued and it is hoped to open a trade between Temerloh and Bentong if suitable freight charges can be arranged.

In the Kuala Langat District of Selangor a number of Javanese are manufacturing coconut oil from their own nuts. The oil is either sold in the local fair or used for home consumption. The average price obtained is 14—16 cents per kati, and since only 4 or 5 nuts are required to make a kati of oil, the undertaking appears to be profitable, the local price for fresh nuts being only \$1.50 to \$2.00 per hundred. In east Pahang oil is also prepared locally and sold at 16 to 20 cents per bottle.

The number of Malays who prepare their own copra is increasing steadily in Selangor and the Bagan Datoh District of Perak. In Province Wellesley South one improved kiln has been erected by Malays and others are contemplated. Arrangements have also been made for the erection of one kiln of improved type in each of the Districts of Muar, Batu Pahat and Kukub in Johore.

This movement in Selangor has caused increased competition among buyers with a consequent rise in the local price of copra, more especially as a few Malay producers are now selling direct to European buyers in Klang District.

The general range of local prices for small-holders' copra showed a slight decrease on that of the previous month at \$3.50 to \$5.75 per picul.

Pincapples.—The fruiting season has again commenced with the result that four canning factories were working in Singapore island and five in Johore. Fruits from Selangor were being sent direct to Singapore where they were sold at \$3.00 per 100. A good crop of fruit was ripening in Klang and Kuala Langat Districts.

Fruit.—The main fruit season on the east Coast appears to differ considerably from that elsewhere, since in Kelantan there were heavy crops of mangosteen, rambutan and langsat, and durians were still plentiful, while durians and mangosteens from Trengganu were on sale at Kuantan.

In the same month in Selangor it was reported that durians and mangosteens were flowering and good crops of rambutans and pulasans were setting. In most of the western areas these fruits have recently set or are not more than half grown, although dukus were still being harvested in quantity in the Muar district of Johore.

Mangoes and horse mangoes were fruiting in Province Wellesley and green mangoes were on sale in Pahang east.

PENANG Gluor Padi Test Station.—Final planting of the main crop was commenced, but before it was completed the whole padi area at Bagan Lepas was flooded as a result of continuous rain and the breaking of the banks of a stream. The floods were the worst experienced locally for 20 years and had not subsided sufficiently at the end of the month to enable an estimate to be made of the damage done.

Planting was completed at the great majority of the Padi Stations and Test Plots, except the new station at Panchang Pedena and the two new plots at Sungei Haji Durani and Tanjong Karang in Kuala Selangor District. At all of the latter, nurseries were sown, but at Panchang Pedena and Tanjong Karang the seedlings were damaged by rats which were plentiful in this newly cleared land and difficult to control. Harvesting was in progress on the two inland plots at Kuang and Kajang in Selangor.

A supply of budded citrus stocks from South Africa was received and distributed to several of the Agricultural Stations.

CAMERON HIGHLANDS. Tana Rata Experimental Plantation.—An additional area of 2½ acres was planted with tea. This forms part of an area of 3 acres on which an experiment to compare the yields of seven different "jats" is being laid down. Work on the pruning and manuring programme continued.

Two plots for certain experiments with potatoes were planted.

A sample of Kents Arabica coffee was prepared and sent to the Malayan Agency for a trade report.

Two orange bushes started to set fruit for the first time and others were flowering.

Village Fairs.

During October fairs were opened for the first time in a further 11 centres in Province Wellesley, Negri Sembilan, Pahang East, Malacca and Johore. In the Rembau District of Negri Sembilan stalls at the fairs are held by Malays only. At a meeting of headmen in Kuala Pilah District the majority were in favour of confining the stalls at fairs in that District to village Malays, but there was considerable difference of opinion on this point. Up to the present there has been an increasing tendency for retail shop-keepers to predominate as stall holders in the weekly fairs in this District.

Instructional Activities.

A party of headmen was conducted over the Pasir Puteh Padi Station in Kelantan on October the 27th and shown the work in progress on manurial and varietal trials.

In Selangor a number of small-holders who have cut out some of their rubber trees to plant vegetables complained that they were unable to grow satisfactory crops on such land. Consequently, a small plot was laid out on old rubber land in Klang District to demonstrate the necessity of using manures for the successful cultivation of food crops and vegetables on such lands. The manures were carefully chosen as being suitable for use by small-holders.

On the 12th. of the month students from the School of Agriculture visited the coconut area of Klang and Kuala Selangor Districts in order to obtain an idea of the copra work in progress. The party was given a simple lecture on the manufacture of copra and shown the details of the two experimental copra kilns at the Coconut Station, Klang. This was followed by a demonstration of copra baling and a visit to several of the local kilns, so that the differences and faults in design could be pointed out.

Poultry Diseases.

At the meetings of copra producers held during the last three months in the west coastal Districts of Johore, the incidence of poultry diseases among village fowls was brought to the notice of all attending. Arrangements have since been made by which subordinate agricultural officers submit regularly returns giving details of the presence of disease in their districts and the seasonal conditions experienced during the month. No outbreaks of disease were reported during October.

DEPARTMENTAL NOTES.

Copra Production on Small Holdings.

Following the recommendation of the Inter-Departmental Agricultural Conference last August, the training of the first Malay Copra Inspector commenced in September. When trained, this officer will advise Malay small-holders on subjects connected with the production of copra, in order that—by turning out a better grade product—they may obtain higher prices.

The enthusiasm amongst Malay small-holders in some districts to prepare and market their own copra has made it difficult for the Department to give sufficient supervision to the initial arrangements for preparing copra. In consequence, there is a tendency for the Malays to repeat the errors of the Chinese copra producers, and to erect kilns far too large for their individual requirements.

Chemical Investigations.

Experimental work on the production of palm oil, carried out in the experimental factory, Serdang, which has been one of the major activities of the Chemical Division for many months, was continued. Tests of the comparative efficiency of the Stork press and the centrifugal extractor indicated that the percentage of recovery of oil is almost identical with both methods.

Among the other numerous activities of this Division were investigation in the feeding values of sweet potatoes and soya beans, the rate of reduction of the oil content of various oil seed meals on storage, and estimation of rotenone and other toxic substances present in tuba root

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S., FOR THE YEAR 1931.

*(Published as Supplement to the "F.M.S. Government Gazette"
of July 29, 1932.)*

CORRIGENDUM.

In the first paragraph on page 3 of the Report—

for the words "AREAS UNDER RUBBER IN MALAYA.—The total area under rubber in Malaya for 1931 is estimated to be 3,076,645 acres. Of this total area 1,412,549 acres is estimated to be in production; the remainder is immature rubber."

read "AREAS UNDER RUBBER IN MALAYA.—The total area under rubber in Malaya for 1931 is estimated to be 3,076,645 acres. Of this total area 1,412,549 acres are estimated to be in production on estates of 100 acres or over, while the total area of rubber which has reached the tappable age is approximately 2,556,000 acres.

Statistical.

MARKET PRICES.

October, 1932.

Rubber.—The Singapore price of rubber smoked sheet equal to London Standard in October varied from 8½ cents to 6 15/16 cents per lb., the average for the month being 7.47 cents as compared with 8.38 cents in September. The average London price was 2.25d. per lb. as compared with 2.71d. in September, while the New York average price was 3.66 gold cents per lb. as compared with 3.77 gold cents in the previous month.

Palm Oil.—The price of palm oil, c.i.f. Liverpool, on a basis of 18 per cent. f.f.a. was quoted throughout the month at £18.10.0, with a steady market.

Copra.—The market in Singapore has continued steady, fluctuating during October from \$5.60 to \$5.80 per picul. The average prices per picul for the month were as follows:—Sundried \$5.75, mixed \$5.20, as compared with \$5.76 and \$5.27 respectively in September. Copra cake has been quoted throughout October at \$2 per picul.

Coffee.—Singapore prices of Palembang coffee have varied but little throughout October, the average price being \$19.56 per picul as compared with an average price of \$19.30 in the previous month. The average price of Sourabaya coffee was \$24.19 to \$26.50, the price within this range depending upon quality.

Areca nuts.—Palembangs have been steady, the average Singapore price for October being \$2.99 per picul as compared with \$2.98 in September. Bila Whole averaged \$3.24 per picul as compared with \$3.18 in September. Average Singapore prices per picul of other grades in October were:—Splits \$4 to \$7.25; Red Whole \$5.19 to \$5.87; Sliced \$6.37 to \$7.37, the price within each range depending upon quality. Kelantan Splits were unquoted.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during September: Siam No 2 \$3.86; Rangoon No. 1 \$3.55, as compared with \$3.88 and \$3.60 per picul respectively in August.

The average retail market prices in cents per gantang of No. 2 Siam rice in September were:—Singapore 30, Penang 30, Malacca 27 as compared with 28, 31 and 28 respectively in August.

Gambier.—Singapore market featureless; prices shewing a tendency to decline. Average prices were: Cube No. 1 \$10.94 per picul and Block \$6.37 per picul, as compared with \$11.90 and \$6 per picul respectively in September.

Pineapples.—Enquiry for the United Kingdom has been small. An adjustment of the Import Duty into Canada has revived the demand for Malayan pineapples and a fair business has been done for that market. Average Singapore prices per case in October were: Cubes \$3.07, sliced flat \$3.01, sliced tall \$3.42, as compared with \$3.18, \$3.38 and \$3.50 respectively in September.

Tapioca.—Singapore market has been quiet. Average prices per picul in October were:—Flake fair \$3.32, Pearl, seed \$4.04, Pearl medium \$4.14. Corresponding prices in September were \$3.33, \$3.98 and \$4.17.

Sago.—Demand in Singapore has been good, resulting in firming of prices. Average prices per picul in October were:—Pearl, small, fair \$4.15, Flour, Sarawak, fair \$2.27, as compared with \$4.27 and \$2.27 respectively in September.

Mace and Nutmegs.—Are in poor demand. Average Singapore prices of mace in October were:—Siouw \$64 per picul as compared with \$64 in September: Amboina \$41.25 per picul as compared with \$43.60 in the previous month.

Nutmegs 110 per lb. \$24, and 80 per lb. \$33 per picul, as compared with \$23.20 and \$32.80 per picul respectively in September.

Pepper.—The Singapore market was dull in October, average prices per picul being as follows:—Singapore Black \$18.31, Singapore White \$24.06, Muntok White \$24.31. Corresponding prices in September were \$19.10, \$25.35 and \$25.90.

Cloves.—Demand slow, nominal prices only being quoted. The following are the average nominal prices per picul in Singapore in October: Zanzibar \$40.75, Amboina \$45.50, as compared with \$42 and \$45.60 respectively in September.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm Oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agriculture products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY*

September, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during September, 1932, amounted to 54,548 tons as compared with 56,856 tons in September, 1931, of which 47.5 per cent. were consigned to Singapore, 19.8 per cent. to Penang, 9.6 per cent. to Malacca, 14.7 per cent. to the Federated Malay States, and 8.4 per cent. to the Unfederated Malay States.

Of these imports 67.7 per cent. were from Siam, 30.3 per cent. from Burma, 1.0 per cent. from French Indo-China and 1.0 per cent. from Other Countries.

Total foreign exports of rice in September, 1932, were 15,345 tons (including 240 tons domestic production exported from Penang) as compared with 11,739 tons in September, 1931. Of these exports 86.1 per cent. went to Netherlands India and 13.9 per cent. to Other Countries.

Net Imports for the period January to September, 1932, were 306,338 tons as compared with 406,695 tons for the same period of 1931, a fall of 24.7 per cent.

India and Burma.—Total foreign exports of rice (*Indian Trade Journal* 6.10.32) during August, 1932, were 113,000 tons as compared with 119,000 tons in July, 1932, and 145,000 tons in August, 1931, decreases of 5 per cent. in respect of the previous month and 22.1 per cent. in respect of the same period of the previous year.

Total exports during period January to August, 1932, were 1,650,000 tons as compared with 1,556,000 tons for the corresponding period of 1931, an increase of 94,000 tons or 6.0 per cent.

Total exports of rice and bran from Burma for the period January 1 to October 1, 1932, amounted to 2,556,079 tons as compared with 2,961,718 tons for the corresponding period of 1931, or a decrease of 13.7 per cent. Of these exports 705,645 tons went to India in 1932 as compared with 1,221,744 tons in 1931, a decrease of 42.2 per cent.

Japan.—The production of the rice crop of Japan for 1932 is estimated at 8,634,000 tons, which is 11 per cent. more than the actual crop of last year.

Korea.—The rice crop this year is estimated at 2,318,170 tons, an increase of 91,949 tons (4.1 per cent.) over the actual crop last year.

Siam.—Exports (approximate) of rice from Bangkok during September, 1932, amounted to 131,255 tons as compared with 70,443 tons in September, 1931 or an increase of 86.3 per cent.

Exports of rice from Bangkok during the period December 1931 to September, 1932, (the figures for August and September 1932 being approximate) amounted to 1,239,735 tons, an increase of 248,798 tons or 25.1 per cent. as compared with the same period of 1930—31.

* Abridged from the Rice Summary for September 1932, compiled by the Department of Statistics, S.S. and F.M.S.

At the end of July 1932, the area under padi in the provinces and inner circle amounted to 2,391,928 acres, an increase of 7.9 per cent. over that of the same time last year.

Netherlands India.—*Java and Madura.* The *Korte Berichten* of September 30, 1932, states that at the end of August, 1932, the area harvested amounted to 8,127,000 acres, an increase of 309,750 acres or 4.0 per cent. as compared with the same period of 1931, the area damaged to 320,647 acres, a decrease of 123,571 acres or 27.8 per cent. compared with 1931 and additional plantings awaiting harvest to 1,141,000 acres, an increase of 154,000 acres as compared with 1931, a total of 9,588,647 acres as compared with 9,248,468 acres for the same period of 1931, an increase of 3.7 per cent.

Imports of rice into Java and Madura during January to August, 1932, totalled 107,110 tons as compared with 195,163 tons for the same period of 1931 or a fall of 45.1 per cent.

Imports of rice into Outer Provinces during January to July 1932, totalled 144,334 tons as compared with 197,422 tons for the same period of 1931 or a fall of 26.9 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932, to September 27, 1932, amounted to 883,231 (metric) tons, a decrease of 9,933 tons or 1.1 per cent. as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to September 30, 1932, amounted to 905,298 (metric) tons, an increase of 118,765 tons or 15.1 per cent. as compared with the same period of 1931.

The *Indian Trade Journal* of September 29, 1932, states that in French Indo-China, the crop of the first semester in Annam was 981,000 acres, as compared with 877,000 acres last year, an increase of 11.9 per cent. and the yield was estimated at 315,230 tons against 244,280 tons during the same period of 1931, an increase of 29.0 per cent.

Ceylon.—Imports for 8 months to August 31, 1932, were 310,138 tons, an increase of 16,764 tons or 5.7 per cent. as compared with 1931.

Of these imports 20.7 per cent. were from British India, 69.3 per cent. from Burma, 3 per cent. from the Straits Settlements and 9.7 per cent. from Other Countries.

Europe and America.—During the period of January 1 to September 22, 1932, 804,469 tons were shipped from the East to Europe, as compared with 914,081 tons for the corresponding period of 1931. Of the 1932 shipments, 54.2 per cent. was from Burma and 36.1 per cent. from Saigon.

For the period January 1 to August 16, 1932, 43,730 tons of rice were shipped to the Levant from the East. In comparison with 1931 this is a decrease of 6.8 per cent.

To the West Indies and America, period January 1 to August 4, 1932, 94,480 tons of rice were shipped from the East, a decrease of 19,695 tons (17.2 per cent.) as compared with the corresponding period of 1931.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT END OF SEPTEMBER, 1932.**

STATE OR TERRITORY	Acreage of Tappable Rubber end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING				ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Percentage of (3) to (2)		Acreage (5)	Percentage of (5) to (2)				
		Acreage (3)	(4)						
(1)	(2)							(7)	(8)
FEDERATED MALAY STATES :—									
Perak	238,420	19,342	8.1	31,647	13.3	50,989	21.4		
Selangor	294,030	20,308	6.9	39,025	13.3	59,333	20.2		
Negri Sembilan	217,002	21,647	10.0	21,518	9.9	43,165	19.9		
Pahang	35,122	8,122	23.1	4,677	13.3	12,799	36.4		
Total F.M.S.	784,574	69,419	8.8	96,867	12.3	166,286	21.2		
STRAITS SETTLEMENTS :—									
Province Wellesley	44,055	3,605	8.2	9,492	21.5	13,097	29.7		
Dindings	6,700	754	11.3	1,055	15.7	1,809	27.0		
Malacca	110,288	4,954	4.5	22,391	20.3	27,345	24.8		
Penang Island	1,585	977	61.6	20	1.8	1,006	63.5		
Singapore Island	28,033	13,325	47.5	3,661	13.1	16,986	60.6		
Total S.S.	190,661	23,615	12.4	36,628	19.2	60,243	31.6		
UNFEDERATED MALAY STATES :—									
Johore	313,385	44,372	14.2	34,519	11.0	78,891	25.2		
Kedah (a)	114,254	11,114	9.7	7,112	6.2	18,226	16.0		
Kelantan (c)	16,785	6,184	36.8	1,590	9.5	7,774	46.3		
Trengganu (b)	4,300	Nil	Nil	2,072	48.2	2,072	48.2		
Perlis	903	106	11.7	462	51.2	568	62.9		
Total U.M.S.	449,627	61,776	13.7	45,755	10.2	107,531	23.9		
Total MALAYA	1,424,862	154,810	10.9	179,250	12.6	334,060	23.4		

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

(c) The figures quoted for Kelantan are those for July—revised figures will be published when available.
The above table together with a Summary was prepared and published by the Statistics Department, S.S.
and F.M.S. on October 26, 1932.

ACREAGES OF TAPPABLE RUBBER OUT OF TAPPING IN NETHERLANDS INDIA AT END OF AUGUST, 1932.

	^A Totally Ceased		^B Partly Ceased		Total A and B	
	Estates	Area in Acres	Estates	Area in Acres	Estates	Area in Acres
Java and Madoera ...	254	166,053	40	12,832	294	178,865
Outer Provinces ...	206	91,980	60	29,428	266	121,408
Netherlands India ...	460	258,013	100	42,260	560	300,273

The total area for August amounts to 32 per cent. of the total tappable rubber as at end of December 1931.

Received by the Statistics Department from the Central Bureau of Statistics, Batavia.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS.

Third Quarter, 1932.

(As declared by estates).

Month 1932.	Palm Oil.		Kernels.	
	F. M. S.	Johore	F. M. S.	Johore
July ...	Tons 578.5	Tons 123.5	Tons 98.4	Tons 9.4
August ...	819.6	130.2	139.1	13.4
September ...	795.7	142.8	124.1	15.1
Total Third Quarter 1932 ...	2,193.8	396.5	361.5	37.9
Total Third Quarter 1931 ...	1,332.6	174.1	188.8	22.0

The total production for the first three quarters of 1932 was :—

Palm Oil : F.M.S. 5,224.7 tons, Johore 912.8 tons.

Kernels : F.M.S. 868.7 tons, Johore 101.8 tons.

The corresponding figures for 1931 were :—

Palm Oil : F.M.S. 3,076.8 tons, Johore 441.9 tons.

Kernels : F.M.S. 461.8 tons, Johore 65.3 tons.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTED,
FOR THE MONTH OF SEPTEMBER, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1				Production by Estates of 100 acres and over				Imports				Exports including re-exports				Stocks at end of month			
	Dealers		Estates of 100 acres and over		during the month		during the month		during the month		during the year 1932		during the month		during the year 1932		at end of month		at end of month	
	2	3	4	5	6	7	8	9	10	11	12	Foreign	Local	Foreign	Local	Foreign	Local	17	18	19
MALAY STATES :—																				
Federated Malay States																				
States	...	14,978	11,826	10,981	105,175	8,305	67,866	NH	NH	NH	NH	15,699	4,896	125,009	52,572	...	14,164	11,360	...	
Johore	...	2,957	3,350	3,560	32,749	2,683	80,525	NH	NH	NH	56	936	5,650	8,876	54,438	...	2,796	3,080	...	
Kedah	...	747	2,034	1,961	20,962	1,115	8,319	NH	NH	NH	NH	830	2,659	6,085	25,775	...	697	1,781	...	
Perlis	...	35	12	5	56	6	53	NH	NH	NH	NH	NH	10	NH	94	...	35	14	...	
Kelantan	...	148	146	168	1,275	376	1,098	50	NH	333	NH	59	492	406	8,077	...	195	140	...	
Tringganu	...	55	50	113	938	57	471	NH	NH	NH	NH	170	NH	NH	1,409	...	58	50	...	
Total Malay States	...	18,921	17,468	16,786	166,455	12,442	109,232	50	11	833	56	17,514	13,877	140,326	134,365	...	17,831	16,435	...	
SEMITES																				
Malacca	...	3,077	1,275	1,334	12,053	...	...	NH	NH	NH	...	4,450	...	36,172	...	...	3,456	1,297	...
Province Wellesley	...	135	561	415	3,996	...	...	NH	NH	NH	...	...	...	...	...	...	138	485	...
Dindings	...	233	108	83	833	...	...	NH	NH	NH	...	...	...	...	...	...	186	94	...
Penang	...	1,591	4,542	12	3	21	...	3,11	13,893	3,512	...	5,808	...	46,367	...	...	463	4,594	...
Singapore	...	2,326	15,701	209	141	1,372	...	6,530	...	45,866	...	14,201	...	137,240	...	...	3,890	16,248	...
Total Straits Settlements	...	3,917	23,678	2,160	1,972	18,275	2,111	17,545	6,841	13,893	49,367	134,467	24,459	219,279	NH	...	4,353	23,622	2,046	
TOTAL MALAYA	...	3,917	42,599	19,618	18,762	178,730	14,553	126,781	6,891	13,904	49,700	134,533	41,973	13,877	366,105	134,365	4,353	41,453	18,515	

TABLE II

Class of Rubber	Fed-erated Malay States				Pro-duced in Straits Settlements				Total			
	21	22	23	24	25	26	27	28	29	30	31	32
DRY RUBBER	11,303	12,887	4,190	8,649	1,138	33,062	...	...	...	...	...	...
WET RUBBER	2,851	2,861	404	231	1,662	7,509	...	...	...	...	...	...
TOTAL	14,154	15,748	4,594	3,780	2,795	40,571	...	...	...	...	...	...

TABLE III
FOREIGN EXPORTS

Ports	during the month		during the year 1932	
	For	From	For	From
Singapore	25,768	23,852
Penang	11,508	82,882
Port Swettenham	4,004	45,439
Malacca	892	9,932
MALAYA	41,978	360,105

TABLE IV
DOMESTIC EXPORTS

Area	For		during the month	
	For	From	For	From
Malay States	85,626	396,601
Straits Settlements
MALAYA	85,626	396,601

Notes :- 1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month + Consumption. Columns [7] = Columns [13] + [14] + [17] + [19] + [19A] - [3] - [18] + [41] - [5] - [9] - [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. Domestic exports are estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States, being domestic production.

5. The report, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st October, 1932.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1932.

Locality	AIR TEMPERATURE IN DEGREES FAHRENHEIT					EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE				
	Means of			Absolute Extremes			Fahrenheit		Fahrenheit		Inches		Days		Total	Daily Mean	Per cent	
	A. Max.	B. Min.	Mean of A and B	Highest °F	Lowest °F	Max. °F	Min. °F	At 1 foot	At 4 feet	Precipitation in or more	Thunderstorm	Fog morning obs.	Gale force					
Railway Hill, Kuala Lumpur, Selangor	90.1	71.6	80.9	93	67	80	75	83.4	84.4	6.38	167.1	2.22	14	12	4	161.05	5.37	44
Bukit Jeram, Selangor	87.7	72.5	80.1	90	70	78	75	83.2	85.2	5.53	140.5	1.04	16	13		186.25	6.21	52
Sitiawan, Perak	90.0	72.6	81.3	94	70	81	74	84.5	85.4	4.61	117.1	1.47	12	8	2	166.40	5.55	46
Kroh, Perak	84.3	69.0	76.7	89	66	78	72	81.0	82.3	11.85	301.0	2.65	24	18	2	140.55	4.69	39
Temerloh, Pahang	88.8	72.1	80.4	92	69	84	75	84.5	85.5	5.47	138.9	1.10	18	17	3	150.10	5.00	41
Kuala Lipis, Pahang	89.7	71.3	80.5	95	67	85	74	83.6	84.9	9.62	244.3	3.67	14	11	4	156.60	5.22	43
Kuala Pahang, Pahang	87.8	73.7	80.7	92	71	85	76	85.6	86.3	3.52	89.4	0.92	14	10	1	196.30	6.54	54
Mount Faber, Singapore	86.8	74.4	80.6	91	70	81	79	81.9	83.0	9.74	247.4	2.38	16	13	4	167.10	5.57	46
Butterworth, Province Wellesley	86.3	73.5	79.9	90	71	78	76	83.2	85.0	16.43	417.3	4.07	21	18		147.20	4.91	41
Bukit China, Malacca	84.5	73.6	79.1	88	71	81	77	82.9	84.0	5.70	144.8	2.26	17	11	3	161.85	5.39	45
Kluang, Johore	87.5	71.3	79.4	92	69	82	73	81.3	82.0	6.74	171.2	2.35	17	14	4	133.95	4.47	37
Bukit Lalang, Mersing, Johore	86.8	71.6	79.2	90	69	85	75	80.9	81.5	10.34	262.6	4.20	14	14	2	157.45	5.25	43
Alor Star, Kedah	86.7	73.9	80.3	90	71	82	76	85.4	86.4	13.40	340.4	2.95	22	20	5	159.45	5.32	44
Kota Bharu, Kelantan	88.8	73.5	81.1	93	71	84	75	84.3	85.4	9.38	238.3	2.11	16	10	4	189.20	6.31	51
Kuala Trengganu, Trengganu	88.6	72.3	80.5	91	69	86	75	83.5	85.2	3.29	83.6	0.96	11	9	4	176.50	5.88	49
HILL STATIONS.																		
Fraser's Hill, Pahang 4268 ft.	73.6	62.5	68.1	77	60	65	65	70.8	71.5	5.18	131.6	1.31	16	12	3	147.95	4.93	40
Pahang Highlands, Tanah Rata, Pahang 4750 ft.	70.9	58.6	64.7	74	53	63	61	69.0	69.3	6.06	153.9	1.43	20	18	5	112.10	3.74	31
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft.	70.3	58.8	64.5	75	55	61	61			6.43	163.3	1.29	21	16	4	119.70	3.99	33

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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tions

As is only to be expected, in connection with padi planting, about which the Malay has built up an elaborate series of immemorial traditions and conventions, no innovation is going to prove immediately acceptable, and therefore

the work of popularising scientifically proved methods of cultivation and pedigree strains of seed is, of necessity, slow. Furthermore, in the matter of these strains, which from their high yield figures it would be thought had adequately proved their worth, there is often a definite prejudice, real or imaginary, against the milling and cooking qualities, the flavour and the nutritive capacity. Thus, it frequently happens that although after several years of trial certain types of padi have been satisfactorily proved to give yields which are consistently higher than those obtained from the popular local varieties, the demand for such seed is remarkably small.

In spite of the foregoing, it can definitely be stated that in a number of areas, the planting of tested and selected seed has increased among the Malay cultivators in the neighbourhood of experiment stations and test plots, and therefore one is led to believe that it is only a question of time before the results of frequent ocular demonstrations will have the desired effect.

Since a marked preference has recently been shown among cultivators for padi which has a short maturation period, more especially in districts where flooding may be the cause of considerable damage, efforts have been made to evolve strains which, while they mature early, retain the desirable qualities of the long-term varieties.

The manurial experiments described in this number which were carried out on five Padi Experiment Stations, have again led to the conclusions reached in previous years; namely, that only in localities where the normal yield is considerably below the maximum yield, have notably increased crops been obtained by the use of fertilisers.

The results of this year's work tend to justify the belief already held that there is a definite maximum yield beyond which manuring on orthodox lines has no significant effect upon the yields of wet padi.

The maximum yield generally possible is held to lie somewhere in the region of 400 to 500 gantangs per acre, and in general, attempts to force yields above this point have been entirely unsuccessful. It is by no means clear whether this is due to conditions inherent in the soil or in the plant, or even possibly to a combination of the two.

There is no question, on the one hand, that compared with rice yields which are obtained in various other rice-growing countries *e.g.* Japan, Italy or Spain, the limit of yield envisaged above is very decidedly low, while on the other hand, it is equally clear that in favoured places in Malaya itself these maximum yields are not infrequently exceeded, yields as high as 800—900 and even more gantangs being on record. It would appear that in certain places in Malaya, therefore, the limiting factors to yields which are normally strongly evident may be absent, and efforts are now being directed to the elucidation of the nature of the limiting factor in question.

An important point which is brought out in Part III of the paper in this Journal is that ability or otherwise of soils to grow a satisfactory crop of padi depends on the presence thereon of considerable quantities of organic material

of recent origin which undergo partially anaerobic decomposition under the water-logged conditions of padi fields. Experiments with various soils in specially constructed tanks at Serdang showed that on arable soils, unless the procedure was adopted of turning in considerable quantities of organic matter immediately before planting out the padi seedlings, the crop would not grow, but when this provision was observed, satisfactory growth was obtained. Soils taken from wet padi land that had lately been under padi did not, however, require this process. Taken in conjunction with the work of investigation in other countries on the application of green manures to padi soils and the observation in relation to manures recorded, it seems not beyond the range of possibility that some inter-connection may lie between the observed limitation of yields on padi soils in Malaya and the condition obtaining in relation to soil organic matter.

The subject is of importance and further developments will be awaited with considerable interest. A further interesting point dealt with is the effective size of plots which can be used in experiments with padi; formerly experimental reaping areas of 1/40 acre each were employed, but with the increase in the work consequent on the rapidly broadening horizon of investigation, it becomes a matter of importance to reduce the size of plots if possible. Statistical investigation of a large number of data obtained during the course of past years has indicated that the size of individual plots can be reduced to 1/120 of an acre without materially affecting the accuracy of the results, thereby enabling very considerable economies in space and effort to be effected and widening the range of problems that can be investigated at any one time.

The series of articles in this number is intended to be in the nature of a progress report and indicates those lines along which definite advances have been made; there are a number of other points under investigation, such as cultivation experiments, experiments on irrigation by pumping, work on insect pests of the crop, work on growing padi on reclaimed mining land, chemical investigation of the composition of different varieties, together with a large amount of effort on distribution of padi seed of which no mention is made in these papers. It is hoped in due course and when further results are available, to publish a full account of the Department's work on padi to date, in the form of a research bulletin.

Livestock Improvement in Ceylon

It is interesting to note that in the October number of the *Tropical Agriculturist*, under the heading of "Livestock Improvement in Ceylon", the editor comments upon conditions among the cattle of the peasant stock owners which somewhat closely resemble those obtaining in Malaya.

The rearing of livestock for milk on a small scale in Malaya is almost entirely confined to the Tamil and Sikh squatters whose herds of ill-nourished and unthrifty animals demonstrate the great need for improvement which exists.

The generally inadequate pasturage, seldom if ever augmented by proper

supplies of stall fodder, and the unsuitable and insanitary stalls into which the animals are herded at night, conditions which attract the attention of even a casual observer in Malaya, are, it would appear, even more prevalent in Ceylon than in this country.

The editor of the *Tropical Agriculturist* suggests that this neglect in Ceylon is due largely to the fact that dairy produce is not regarded as an essential part of the normal diet of the peasant, the coconut supplying as it does the fats necessary in human food.

The lack of interest in cattle farming among the Malays may certainly be attributable to the same cause; the buffalo is almost without exception, the only type of stock raised by the Malay, for use as a draught animal, for work in the padi fields and for slaughter. In spite of the fact that milk is comparatively little used in the Malay homestead, there is a slowly increasing demand for the condensed article among the more enlightened, and when one considers the fact that during the period 1929 to 1931 the average yearly value of milk of all kinds, imported into Malaya was \$11,442,802 and of butter \$3,168,810 (Straits currency) the large quantities consumed by the alien population can be realised and the need for greatly increased local production is appreciated.

EXPERIMENTS WITH PADI IN MALAYA 1931-32*

The papers which follow give an account of various aspects of padi research during the season 1931—1932. Tables I, II and III show the characteristics of the five Experimental Stations and nineteen Test Plots at which the work was performed. Results from Kedah and Perlis are included by courtesy of the Governments of these States.

The officers mentioned in Table I were responsible for demarcation, planting and recording and should be regarded as joint authors of Parts I—III of this article. Similarly, Messrs. J. N. Milsum, T. D. Marsh and J. L. Greig, Assistant Agriculturists, should be regarded as joint authors of Part IV.

In all the main padi areas the season was almost an ideal one as far as weather conditions were concerned, for well distributed rainfall was general throughout the padi growing period and dry weather at harvest reduced harvesting losses to a minimum, while pests, especially rats and padi stem borers, were less in evidence than has been the case for some years. Adverse conditions were, however, experienced in certain areas, notably in eastern Pahang where floods ruined much of the crops and in the coastal areas of Selangor, where exceptionally high tides coupled with very strong west winds resulted in the destruction of a large area of young padi, owing to the presence of salt water in the fields, a result which stresses the need for bunding flat coastal areas.

Experiments on the reclamation of recently mined land at Kamunting gave inconclusive results and will be continued.

Trials on different methods of cultivation before planting carried out at Bukit Merah, Selinsing and Telok Chenghai gave no definite results and will be continued for another season. (W.N.C.B.)

TABLE I.
Padi Stations Season 1931—32.

STATE	STATION	OFFICER IN CHARGE	METHOD OF IRRIGATION
<i>Experiment Stations.</i>			
Kedah	Telok Chenghai	W. N. Sands	Rainfall.
Perak	Titi Serong	H. W. Jack	Krian Reservoir and Irrigation canal.
	Talang	H. D. Leighton	Dam in stream and conduit.
Province			
Wellesley	Bukit Merah	F R Mason	Rainfall, supplemented by dam in drainage canal and conduit
Malacca	Pulau Gadong	{ C. L. Newman R. G. Heath	Dam and conduit, supple- mented by pump.

* An account of field experiments with padi for the season 1930—31 was given in this Journal in December, 1931.

STATE	STATION	OFFICER IN CHARGE	METHOD OF IRRIGATION
<i>Test Plots</i>			
Kedah	Jitra	W. N. Sands	
	Langgar	"	
	Sala Kanan	"	
	Rantau Panjang	"	
Perak	Bruas	H. D. Leighton	Dam and conduit.
	Bukit Gantang	A. E. Coleman-Doscas	Dam and conduit.
	Kamunting	A. E. Coleman-Doscas	Dam and conduit.
	Lenggong	H. D. Leighton	Hill stream.
	Selinsing	A. E. Coleman-Doscas	Krian reservoir and canal.
Province			
Wellesley	Glugor	F. R. Mason	Hill stream.
Selangor	Kajang	H. J. Simpson	"
	Kuang	"	"
Negri Sembilan	Kendong	W. H. Barnes	
Malacca	Alor Gajah	C. L. Newman	
		R. G. Heath	
Pahang	Dong	J. Fairweather	
		{ J. M. Howlett	"
	Pekan	J. M. Howlett	Conduit.
	Temerloh	{ J. Fairweather	Rainfall.
		J. M. Howlett	

In addition there were two Test Plots in Perlis at Arau and Sanglang which were controlled by the British Adviser.

TABLE II.
Rainfall during the Growing Season.

		Inches									
STATION		1931								1932.	
		May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Telok Changai	...			5.27	7.46	8.70	16.67	5.30	13.35	Nil	
Titi Serong	...	8.18	12.64	3.95	4.34	7.05	8.41	6.06	7.20	2.27	8.96
Talang	...			not available							
Kuala Kangsar	} ...										
1½ miles distant		2.99	5.18	3.21	3.97	5.68	9.00	10.05	16.44	3.88	5.28
Bukit Merah				not available					11.97	.27	6.12
Butterworth											
4½ miles away	...			4.37	5.33	5.38	13.78	5.77			
Pulau Gadong	...	17.00	11.93	11.49	6.09	19.60	7.95	9.65	9.76	2.44	2.82

TABLE III.

Soil Analyses (Top Soils)**(a) Mechanical.**

Stations		Percentages.					
		Clay	Silt	Fine sand	Coarse sand	Gravel	Loss on Ignition
Telok Chengai	...	59	27	11	Nil	Nil	11
Titi Serong	...	51	35	10	Nil	Nil	12
Talang	.	44	24	18	9	2	12
Bukit Merah	...	47	12	33	4	Nil	7
Pulau Gadong	...	33	37	29	Trace	Nil	7

(b) Chemical.

Stations		Percentages.							
		K ₂ O	P ₂ O ₅	CaO	Sesqui oxides	Fe ₂ O ₃	MgO	N	C
Telok Chengai	...	0.96	0.05	0.20	21.8		0.03	0.14	4.3
Titi Serong	...	0.53	0.06	0.03	26.2	3.47	0.01	0.19	1.6
Talang	...	1.09	0.08	0.22	23.3	4.19	0.41	0.22	2.4
Bukit Merah	...	0.22	0.04	0.05	17.7		0.03	0.21	1.3
Pulau Gadong	...	0.62	0.03	0.04	12.2	1.77	0.45	0.14	2.6

Part I.

BREEDING AND VARIETAL TRIALS.

BY

H. W. JACK, R. B. JAGOE AND B. A. LOWE.

Test Plots planted for the first time this season are four in Kedah at Jitra, Langgar, Sala Kanan which gave useful results and at Rantau Panjang where the trials were damaged by floods; at Temerloh and at Pekan in Pahang, Kendong near Rembau in the Negri Sembilan; at Bukit Gantang and at Bruas in Perak all of which suffered in different degrees from various difficulties met with in opening up new land.

No results worth mentioning were obtained from Pekan and Temerloh.

Titi Serong Experiment Station, Krian.

The experiments at this station during last season included yielding tests of selected pedigree strains, the maintenance of pedigree and foundation stock lines, seed multiplication plots, field observation plots for recently introduced varieties, selection of suitable strains from recently introduced varieties, investigation of controlled hybrid populations, test of the amount of natural cross-pollination between different varieties in the field, manurial and cultural observations and the continuance of various meteorological records.

Despite the collapse of the irrigation spill weir during the season, a well distributed rainfall resulted in good growing conditions, while the harvest was favoured with fine weather, hence good crops were produced.

The varietal trial included seven long maturation period and 14 early ripening pedigree strains. These were tested in 6 replications randomised within blocks, and results showed that several of the long maturation strains were significantly better than several of the early ripening series vide Table II. No significant difference of yields were found within the long maturation series but the best yields were obtained from Seraup 371 (3,200 lbs. per acre), S.48 (3,140 lbs.), S. 68 (3,050 lbs.) S. 15 (2,990 lbs.) and S. 36 (2,880 lbs. per acre). S. 36 suffered loss of grain from overripeness.

Of the earlier ripening types, the best crops per acre in order of yield, were obtained from Radin 7, Radin 4, F.S. 756 (Nachin), Nachin 10 (a Nachin strain selected at Pulau Gadong, Malacca), F.S.55 (Mayang Kuning), Radin 13, Radin mixture, Siam 29 (also from Malacca), Radin 11 and Radin 2. Local popularity in the vicinity of the station, as gauged by the appearance of the crop in the field and of the grain after harvest, places Seraup 48, Seraup 36, Radin 4, Radin 2, Nachin 10 and Siam 29 in the forefront with a preference for Seraup 36 and Radin 4 in areas where water supply is abundant and Radin 2 where water is liable to be inadequate. Siam 29 and Nachin 10 produce good crops but possess weak straw which it is hoped to strengthen by crossing, with strong strawed strains. Nachin F.S. 756 produced a good crop and has stiff straw.

Radin and Seraup mixture did fairly well but showed no improvement over pedigree strains.

TABLE I.

Yields from varietal trial, Titi Serong Experimental Station, Krian.

Strain			Maturation period Days	lbs. per plot (1/109 ac.)	Standard deviation : lbs per plot	lbs. per acre	Standard deviation : lbs. per acre
Over 7 months	Seraup 371		240	29.3	4.5	3,200	490
	" 48		240	28.8	2.4	3,140	260
	" 68		240	28.0	2.4	3,050	260
	" 15		238	27.3	2.5	2,990	270
	" 36		235	26.4	2.7	2,880	350
	" 6		238	26.3	1.3	2,860	140
	" 1		235	24.4	1.8	2,670	200
	" Mixture	A	240	26.8	1.0	2,910	110
	" "	B	245	25.6	2.4	2,780	260
Under 7 months	Radin 7		210	22.4	3.4	2,450	370
	" 4		210	21.3	1.8	2,320	200
	" 13		185	20.4	2.0	2,240	220
	" 11		180	19.6	2.5	2,140	270
	" 2		180	19.2	1.6	2,100	170
	" Mixture		190	20.3	1.9	2,210	210
	Pahit 1		215	18.8	0.7	2,070	80
	Siam 29		200	20.0	4.4	2,180	480
	Mayang Kuning						
	F.S. 55		200	20.5	1.8	2,250	200
	Milek Puteh F.S. 148		180	16.6	2.5	1,810	270
	Nachin F.S. 756		170	21.2	3.6	2,310	390
	" F.S. 8		170	16.3	2.0	1,780	220
	Nachin 10		170	21.1	1.7	2,300	190
	" 48		170	14.9	2.1	1,620	230

In conjunction with the work of this station subsidiary tests of pedigree strains in randomised replicated plots (3 to 8 replications) were established in 8 sub-stations and the best average yields per acre in pounds are shown in table II.

TABLE II.

Average Yields from Plots of Pedigree Strains.

Locality	Selection	Replications	Yield Lbs. per acre	Straw
Kampong Perak	Nachin F.S. 756	5	2570	Strong
"	Milek 148	5	2290	"
"	Nachin 10	6	2080	Weak
"	Radin 4	6	2060	Strong
Gunong Semanggol	Nachin 10	6	2050	Weak
Kuala Kurau	Seraup 15	6	2260	Strong
Tangjong Piandang	Radin 2	8	1970	Strong
"	Radin 4	8	1910	"
Bagan Serai	Seraup 1	4	1780	"
Bagan Tiang	Seraup 36	3	2430	"
"	Radin 4	3	2270	"
Alor Pongsu	Nachin 10	3	1150	Weak
Selinsing	Radin 2	3	950	Strong
Titi Serong	Nachin F.S. 756	3	2730	"
"	Seraup 15	3	2840	"

The above yields were better than those from unselected padi.

Hybridisation. From 1927 to 1930, experiments were conducted with the object of developing and perfecting a technique for cross-pollination of padi, suitable to local conditions.

The F₂ generation of the surviving Radin Nachin "Crosses" from the 1929—30 season's experiments were sown at Titi Serong last season (1931—32).

One of the joint authors who had been conducting these experiments, was on leave during most of the season and only returned just in time for harvest so that a full record of the characters of the segregating types was not possible.

Counts of grain characters were, however, made and showed that white glumes are dominant to straw-colour glumes, longness of grain is dominant to shortness, and broadness to slenderness.

A combination of these characters segregated in numbers approximating to the Mendelian ratios 1, 3, 3, 3, 9, 9, 9, 27, so that there appears to be a simple relationship between each of these pairs of characters.

These plants, the results of technique experiments, are interesting in being the first hybrids, known to have been obtained experimentally, in Malaya which are available for study. Last season, however, 12 new "crosses" were made which aim at combining the most desirable characters of two selected strains.

High yielding but weak strawed Siam 29 and Nachin 10 have been "crossed" with each of the following strong strawed varieties Radin 2, Seraup 36, and Nachin F.S. 27.

The late maturing, heavy yielding Seraup 36 has been "crossed" with the early Serendah F.S. 875 and late maturing, heavy yielding Seraup 15 with early strong strawed Nachin F.S. 27. Siam 29 and Nachin 10 have been "crossed" with each other and with Serendah F.S. 875, and Radin 4 has also been "crossed" with Serendah F.S. 875.

It is hoped that some of these cross-pollinations will produce valuable new strains, particularly those which aim at strengthening the straw of Siam 29 and Nachin 10.

Experiments designed in 1929 to trace the amount of natural cross-pollination which may take place under Krian conditions showed that some types more readily hybridise than others but that on the average, natural cross-pollination did not amount to 1 per cent.

Pulau Gadong Experiment Station, Malacca.

The season under review was a good one from every aspect, rainfall was abundant and well distributed, pests did little damage and the harvest was reaped in dry weather.

Selection work with the chief local varieties, Padi Nachin, Padi Siam, and Padi Radin Siak, was continued on the lines previously adopted. Of the first series of Nachin selections, 6 were tested for yield against local unselected Nachin in randomised plots (.003125 acre in size) in five adjacent blocks. Borer attack, together with a probable soil fertility gradient, caused wide variation between the strains tested.

Statistical examination of yields showed that N. 10 and N. 66 are significantly better than N. 50, N. 67 and the control, while N. 11 is almost similarly superior.

N. 10 displayed its characteristically weak straw. No. 66 is a popular type which does not easily shed its ripe grain and, in common with N. 11, possesses moderately good straw.

TABLE III.

Results of Trials with Strains of Padi Nachin

Variety	Maturation Period days.	Mean Yield grms. per plot.	Mean Yield lbs. per acre.	
Nachin 10	179	3,654	2,598	
" 66	184	3,628	2,579	
" 11	184	3,544	2,518	
" 70	176	3,246	2,307	
" 50	184	3,116	2,214	
" Control	186	3,014	2,144	
" 67	169	2,794	1,987	
				The significant difference between mean yields is 472 grammes per plot.

Similarly, 5 Padi Siam selections were tested against a local unselected sample of the same variety with the average results as tabulated below. Siam 29, Sm. 66 and Sm. 18 proved to be significantly better yielders than the unselected padi, while Sm. 29 and Sm. 66 were significantly superior to Sm. 76 and Sm. 72. Under the station conditions Sm. 29 did not yield as heavily as N. 10 in the past season, but it is a more popular eating padi.

TABLE IV.
Results of Trials with Strains of Padi Siam

Variety	Maturation Period days.	Mean Yield grms. per plot.	Mean Yield lbs. per acre.	
Sm. 29	184	3,920	3,110	This trial was laid out in general randomisation, not randomised within blocks. Treated as a completely randomised block the significant difference between mean yields is 604 grms
" 66	184	3,622	2,875	
" 18	192	3,488	2,770	
" 76	176	3,206	2,545	
" 72	184	3,228	2,560	
" Control	190	3,848	2,260	

It is interesting to note that in the manurial experiment plots all the above strains of Nachin and Siam matured between 20 and 30 days earlier than those periods recorded above.

Ninety-nine rows of a second series of Nachin types were grown in ear-to-row lines for selection purposes. Of these, several show promise, while N. 199 was outstanding in yield per plant, and had good grain and straw characters. Twenty-two strains were selected for further trial. In this series, 35 lines showed heterozygous characters and from these, 45 types were picked out for further investigation next season.

Fifty-five rows, of a similar series of Siam types, were grown, 32 lines showed heterozygous characters and 63 types were isolated from them for further examination. The low proportion of plants which breed true to type is characteristic of Padi Siam in Malacca. Only 9 of the lines which were true to type appeared worthy of further trial in the next season.

In connection with the search for a strong strawed, early ripening, heavy yielding type, 116 ear-to-row lines of padi Radin Siak were grown for the second season and examination of grain, yield and field characters made it possible to discard 65 lines, the remainder being kept for further observation next season. Two lines R.S. 17 (93 grms per plant) and R.S. 24 (100 grms per plant) showed particular promise as good yielders with stout straw; these and 6 more, were deemed worthy of trial next season in "checkerboard" plots.

Nineteen lines of Milek Puteh and 5 lines of Melik Kuning, well known Pahang types, gave yields and show promise under Experimental Station conditions but the field of selection is very limited by such a small number of types. Four of the former and one of the latter types were discarded as possessing undesirable characters. In addition, 7 Titi Serong selections were grown as ear-to-row lines for observation purposes and of these Nachin F.S. 27, originally

selected at Rembau for its earliness and strong straw, and Radin 11, gave good crops and show promise.

Nine multiplication and field observation plots at the Station confirmed the yielding ability of Nachin 10, despite its weak straw, the average yield of all these plots being 2,610 lbs. of grain per acre. Nachin 11 and Nachin 66 with average yields of 3,020 (2 plots) and 2,960 (1 plot) respectively, also yielded highly and seem promising. Siam 29 in 13 plots averaged 2,720 lbs. per acre while Siam 76 (1 plot) with good straw yielded 2,680 lbs. per acre and Siam 18, 66 and 72 produced at the rate of 2,760, 2,520 and 2,960 lbs. per acre respectively, though all three were "lodged" at harvest time owing to weak straw. Titi Serong selections, Nachin F.S. 756 and Serendah F.S. 824, in single plots yielded at the rate of 2,800 and 2,240 lbs. per acre respectively. The very early ripening variety Radin Siak grown in 17 plots, situated on high ground gave an average yield of 334 gantangs (or 1,815 lbs.) per acre, which is quite good under the circumstances.

Talang Experiment Station, Kuala Kangsar.

At this area 9 selected strains were tested against the local padi Radin in randomised, 1/40 acre plots quadruplicated in blocks.

TABLE V.
Results of Varietal Trials at Talang.

Order of Merit	Strain	Maturation period days	Average Yield in lbs.		Order of Merit	Strain	Maturation period days	Average Yield in lbs.	
			per lot	per acre				per plo	per acre
1	Radin 2	180	75.7	3024	6	Radin 13	185	68.8	2752
2	Mayang Ebos 202	170	74.7	2988	7	Nachin F.S. 27	172	68.2	2728
3	" 208	170	73.4	2936	8	Local Radin	199	66.1	2644
4	Radin 4	184	70.8	2842	9	Mayang Ebos 201*		62.7	2508
5	Mayang Ebos 209	170	69.4	2776	10	Serendah F.S. 741	172	52.7	2108
Significant difference between average yields per plot = 10 lbs.									

Radin 2 showed 15 per cent. increase over the control and selected strains Nos. 2, 3 and 4 also showed material increases but in no case were the selections significantly better than the control, though it is doubtful if the control itself was not originally derived from some previously grown, selected strains.

Bukit Merah Experiment Station, Province Wellesley.

During the last season, 11 selected strains were tested against the most popular local variety—Mayang Ebos—in randomised blocks replicated 6 times. The season was an excellent one from every point of view and high average yields were obtained.

* The maturation period of this padi is not given as some of the seedlings came from another Station where seed was sown earlier than at Talang, a record of period would therefore be misleading. The above fact is probably largely the cause of its low yield.

TABLE VI.
Results of Varietal Trials at Bukit Merah.

Strain	Maturation period days	Average Wt. of Grain in lbs.		Strain	Maturation period days	Average Wt. of Grain in lbs.	
		per plot	per acre			per plot	per acre
Seraup 15	218	56.42	2257	Radin 13	175	51.33	2052
Nachin 10	169	56.08	2243	Nachin F.S. 756	140	50.60	2024
Mayang Ebos Local	173	55.67	2226	Seraup 36	219	49.58	1983
Mayang Ebos 205	179	54.92	2196	Mayang Ebos 39	225	45.67	1816
Siam 29	165	53.58	2143	Radin 2	177	44.58	1783
Siam 63	175	52.42	2096	Nachin F.S. 27	169	44.53	1781
Significant difference between average weight = 7.0 lbs. per plot.							

Statistical examination of the plot results showed that the variance due to varietal difference was significantly greater than that due to randomisation and that there was no "fertility drift" over the experimental area. None of the strains tested was significantly superior to the local variety Mayang Ebos though Seraup 15 and Nachin 10 gave very slightly better yields and selected Mayang Ebos 205 almost equalled it. Seraup 15, Nachin 10 and Siam 29 were significantly better than Radin 2, Nachin F.S. 27 and Mayang Ebos 39.

Nachin 10 and Siam 29 lodged badly during the dry harvest, while the local Mayang and the selected Mayang Ebos 205 also showed a tendency to lodge. This fault might result in a heavy loss should the harvest occur in wet weather.

Serendah F.S. 824, which was, unfortunately, not included in the varietal test and which gives a very popular eating rice, produced the highest crop in the Test Station for the season.

Mayang Ebos 203, grown in a multiplication plot, also exceeded in yield all the varieties in the varietal trial.

Telok Chengal Experiment Station, Kedah.

Pedigree line selection experiments with the chief varieties of padi cultivated in North Kedah were commenced at this station last season. The varieties of which ears were obtained are Mayang Ebos, Radin Che Nah, Reyong and Radin China—popular main crop, 6 months padis and Kunchor, Chempah Puteh and Chubai—early maturing varieties. Padi Chubai is also a variety cultivated in areas subject to flooding by salt water.

A large number of ears of each variety were selected on appearance in the field. They were subjected to further examination in the laboratory and the following number of ears were reserved for sowing in ear-to-row lines:—

Mayang Ebos	...	100
Radin Che Nah	...	99
Reyong	...	50
Radin China	...	20
Chempah Puteh	...	74
Kunchor	...	30
Chubai	...	30

Ears were sown on 22nd. and 23rd. July, 1931, on floating nursery-beds; seedlings were transplanted in the nursery on 5th. and 6th. August and finally transplanted in lines on 19th. to 21st. August.

Growth and vegetative and grain characters were examined during the season, with particular attention to yield of grain, straw strength and early ripening. Some of the lines of Mayang Ebos, Radin Che Nah and Reyong displayed heterozygous characters.

The following number of lines were selected and harvested :—

Mayang Ebos	... 62	Radin China	... 14
Radin Che Nah	... 85	Kunchor	... 4
Reyong	... 24	Chempah Puteh	... 6
		Chubai	... 20

Ears of one plant in each selected line were taken for seed and the ears from the remaining plants were subsequently examined and measured in the laboratory and the weight of grain recorded.

Lines of the 4 main-crop varieties were further recorded in numbers and only those yielding over 7,000 grammes of cleaned grain were reserved for further selection next season and are as follows :—

Mayang Ebos	... 46 lines
Radin Che Nah	... 29 „
Reyong	... 11 „
Radin China	... 10 „

Varietal trials were conducted at four Test Stations and are referred to elsewhere in this summary.

Alor Gajah Test Plot, Malacca.

At this test plot, five varieties of padi Nachin and Siam and one variety of Radin were tested against each other and against local strains of these types. Unfortunately, late sowing of several varieties caused failure through flooding and insect-damage.

Results confirm those obtained at the Pulau Gadong Station, Siam 29 averaging 550 gantangs per acre as compared with 415 gantangs per acre from the local Siam type. Nachin 10 also gave satisfactory results, averaging 50 gantangs per acre more than the local Nachin.

The varietal trial was laid out in six replicated blocks each containing the seven varieties in randomised plots. Siam 29 proved significantly better than both Kampong Siam and Nachin 10, while Nachin 10 proved better than Kampong Nachin. Owing to the late planting and consequent damage, the local Kampong Nachin was significantly better than the selected Nachin 22.

The test plot suffers to a considerable extent from flooding and the difficulty of draining at harvest, but owing to local conditions (system of land-tenure and density of population) it is difficult to acquire any other more satisfactory site.

Kendong Test Plot, Rembau.

This plot was newly opened for the past season and suffered the usual setbacks encountered in starting Test Plots in new areas. The land became available after the season had already commenced so that a late start was made. moreover, many alterations of the small bunds, or banks dividing the plots, were necessary and resulted in bringing raw subsoil to the surface, with consequent detriment to the padi crop. The area was divided into blocks and planted with 12 varieties in 1/40 acre plots with random distribution over each block, but immediately after transplanting and before the plants had become established, a series of floods wrought so much damage that the crops were even more disappointing than was anticipated. A hardwood flume was installed for water conduct, so that the water supply is good and the area should prove quite useful as a Test Plot next season, except for the fact that the subsoil in some of the plots may still be insufficiently weathered. The few sandy plots should only be used for multiplication purposes. The plantings last season included Radin 13, Seraup 36, Siam 29, Mayang Ebos 206, Nachin 10, Radin Siak 10, Nachin F.S. 27, Serendah F.S. 11, local Radin, Radin 2, Serendah F.S. 8, in the order of the crops which they produced, but this order is not indicative of potentialities since damage was irregular throughout the area. Radin 13 and Seraup 36 each produced at the rate of 240 gantangs per acre but all the rest of the varieties failed to exceed 200 gantangs per acre.

Kuang Test Plot, Selangor.

At this Test Plot 9 pedigree selections were tested against the best local variety, known as Padi Rambai Puteh, in randomised 1/40 acre plots replicated 9 times. Shortly after planting, the padi suffered severely from stem borers, necessitating a good deal of replanting which gave the crop a very uneven appearance and greatly prolonged the harvesting period which was wet and led to irregular losses according to type of padi. Grain sucking insects also caused some losses in the early ripening types but rat damage was negligible.

TABLE VII.
Results of Varietal Trials at Kuang

Strain	Maturation period days	Average Yield in lbs.		Strain	Maturation period days	Average Yield in lbs.	
		per plot	per acre			per plot	per acre
Siam 29	220	58.4 ⁺ 13.5	2336	Nachin F.S. 27	184	30.0 ⁺ 5.4	1200
Nachin 10	213	44.7 ⁺ 8.5	1788	Radin Siak 10	172	29.8 ⁺ 5.2	1192
Radin 13	232	33.9 ⁺ 9.9	1356	Seraup 36	264	27.5 ⁺ 11.5	1100
Radin 2	222	33.6 ⁺ 5.5	1344	Seraup 48	267	21.6 ⁺ 5.3	864
Control	239	32.5 ⁺ 8.2	1300	Radin 4	248	18.8 ⁺ 8.2	752

The plots were not randomised within blocks and general randomisation resulted in high standard deviations in yields of all the selections, therefore no significance can be derived from the results. The local cultivators took considerable interest in the work of the station during the season and in the early ripening Nachin F.S. 27 and Radin Siak 10 in particular, and seed of these two selections is in demand.

Kajang Test Plot, Selangor.

Owing to the unsuitability of this area for the conduct of standardised tests only 3 selections (Radin 2, Radin 13 and Nachin F.S. 27) were planted in the last season. Planting operations, also, were seriously delayed by the contractor and the irrigation dam collapsed early in the season so that the young padi suffered severely from drought, and slightly from stem-borers and grain-suckers, while the Radin selections were badly damaged by birds. The results indicated that Radin 13 (2,009 lbs. per acre) gave the best crop but popular opinion favoured Nachin F.S. 27 (1,910 lbs. per acre) on account of its earliness: seed of this selection is in demand for next season.

Dong Padi Test Plot, Raub.

Eleven strains of padi were planted at Dong last season. Of the strains tested in previous years, 5 strains namely Seraup 15, S. 52, S. 48, Radin 3, and R. 7 were omitted this season. R. 4 being retained in place of R. 7 because R. 7 was not popular for eating in the locality; and 4 strains, namely Siam 29, Nachin 10, Mayang Ebos 210 and Nachin F.S. 27, were included for the first time. Varieties were planted in 1/40 acre plots, and randomised in six blocks.

Planting and all other work was carried out by day labour and was found to be an improvement on the previous system of employing a contractor. Harvesting continued throughout January and February, as some of the short and long term padis were sown at the same time causing ripening at intervals over a fairly long period.

During the flowering period, extremely heavy rains were experienced resulting in "lodging" in some of the plots. In a few cases, previous rat damage had made the padi more liable to lodging.

Crops were, however, better in every respect than those previously recorded at this station. Seraup 36 gave the best yields and Radin 13, R. 4, Serendah F.S. 875 also gave average yields of over 500 gantangs per acre (equivalent to about 3,000 lbs. per acre).

Radin 2, Siam 29, Nachin 10, Mayang Ebos 210, Nachin F.S. 27, which were sown too early, and the early ripening plots of the local padi Jambak Bawang, suffered damage by pests and heavy rains.

TABLE VIII.

Results Varietal Trials at Dong: Yield figures are in gantangs.*

Strain	Maturation Period days	Mean Yield per 1/40ac plot	Mean Yield per acre	Significance over local variety
Seraup 36	221	13.66	547	Greater
Radin 13	212	12.74	510	"
Serendah F.S. 875	172	12.73	509	"
Radin 4	213	12.66	507	"
Pahit 1	221	11.17	447	Nil
Siam 29	199	10.54	423	Nil
Mayang Ebos 210	203	10.33	413	Nil
Nachin 10	200	9.83	393	Nil
Nachin F.S. 27	190	9.82	393	Nil
Radin 2	196	9.58	383	Nil
J. Bawang (Local Padi)	218	7.48	299	—

Significant difference between mean yields per plot = 3.78 gantangs.

Variation in plot yields is, in some cases, considerable, due to causes above mentioned, and the significant difference is therefore fairly high.

Four varieties,—Seraup 36, Radin 13, F.S. 875, and Radin 4, however, have given yields significantly greater than that of the local padi Jambak Bawang.

Statistical examination of the results shows that Seraups 36 and 15 are significantly better than the local Seraup variety. Amongst the early ripening types Radin 4, Siam 29 and Radin 2 are significantly better than the local Radin while Radin 7 and F.S. 27 are better but not significantly so. Nachin 10 yielded poorly and may possibly have been unfortunate in the random positioning of its plots, as one plot yielded more than the best of all the controls plots, nevertheless it obviously did not stand the conditions well.

Lenggong Test Plot, Upper Perak.

At this plot, the long maturation period Seraup strains Nos. 1, 15 and 36, were tested against the local Seraup variety (which is possibly derived from Seraup distributions in this neighbourhood about 1919—20.) in randomised plots in 10 blocks. The earlier maturing strains Nachin 10, Siam 29, Radin 2, Radin 4, Nachin F.S. 27 and Radin 7 were likewise tested in 6 randomised blocks against the local Radin variety, which again is possibly derived from previous distributions of selected strains in this area. All varieties showed good, robust growth and high tillering, except in patches where the water was rather deep. Such patches proved to be evenly distributed amongst the varieties. Owing to the heavy crops, heavy rains and strong winds, "lodging" at harvest was common to all varieties in certain places; Nachin 10 was the worst in this respect, while Seraup 36 and Radin 4 appeared to be the most resistant. .

* 1 gantang = 1 imperial gallon.

TABLE IX.
Results of Varietal Trials at Lenggong

Strain	Maturation period : days	Mean Yield per plot. lbs.	Mean Yield per acre. lbs.	Significance over control.
Seraup 36	217	94.9	3800	Better
" 15	217	94.0	3770	"
" 1	217	82.8	3340	Nil
" Local	217	80.4	3220	
Significant difference between mean yields per plot = 12.6 lbs.				
Radin 4	202	85.9	3630	Better
Siam 29	187	89.5	3580	"
Radin 2	184	88.4	3540	"
" 7	200	85.4	3420	Nil
Nachin F.S. 27	190	79.0	3160	"
Radin Local	202	67.6	2590	"
Nachin 10	187	50.4	2020	"
Significant difference between mean yields per plot = 18.5 lbs.				

Bukit Gantang Test Plot, Taiping.

This plot was used for the first time last season and suffered from several defects common to new areas. Eight selections and one control variety were planted in this area in 4 randomised blocks. Cultivation was delayed by drought but at planting time growing conditions were favourable. The young padi suffered severely from rats, the depredations of wandering cattle, variations in the water supply which led to much trouble from weeds, and from shortage of labour and storage facilities at harvest so that crops were variable but still good under the circumstances, as is shown in the table below.

TABLE X.
Results of Varietal Trials at Bukit Gantang.

Strain	Maturation period days	Mean Yield lbs. per acre	Strain	Maturation period days	Mean Yield lbs. per acre
Radin 4	210	2985	Radin 2	198	1778
Nachin 22	191	2762	Nachin 27	203	2124
Pahit 1	211	2492	Local Radin	195	1702
Radin 7	199	2452	Serendah F.S. 741	199	1233
Radin 13	198	2102			
Significant difference between mean yields per acre = 730 lbs.					

With large variations within the varieties, due to the numerous adverse growth conditions, significance would only be reckoned on differences of 730 lbs., but Radin 4 was significantly better than Nachin F.S. 27, R. 13, R. 2, local Radin,

and Serendah F.S. 741, and Nachin 22, though it lodged badly, was better than Radin 2, local Radin and Serendah F.S. 741.

Many of the adverse circumstances encountered should be remedied next season and thus lead to more precise comparisons in the future in this important area.

Bruas Padi Test Plot, Perak.

This Station was commenced for the first time last season. An area of five acres was selected and a strong batas, or bank, built round it.

Preparation of the land took longer than was expected, as there were many tree stumps to be removed and much levelling to be done.

The 5 acre area is divided into three subdivisions, each being one and two-thirds of an acre; the whole being an accurately measured rectangle, 10 chains by 5 chains.

The following varieties were planted for yield trials in 1/40 acre plots randomised in three blocks, with four replications in each block:—

Serendah F.S. 741, Mayang Ebos 201, Nachin F.S. 27, Radin 2, Radin 4, Radin 7, Radin 13, and local Radin; and Seraup 1, Seraup 36, Seraup 15 and local Seraup.

The land was lower at one end of the Station than the other, and the Seraup strains were planted at this end, so that there are, in effect, two trials, one of Seraups and the other of Radins, each randomised in three blocks.

The Seraups showed good growth, but the growth of Radins and other short term varieties was poor. The area is very patchy, with irregularities in soil and levels. The plots suffered from temporary lack of water in January owing to a broken dam, and later, the plots could not be properly drained on account of various other difficulties. These difficulties being known, it will be possible to guard against them next season.

As was to be expected in newly cleared land, considerable damage was done by pests, chiefly rats and stem-borers.

The local Radin strain gave comparatively excellent yields. The average yield being the highest for the whole experiment and it might be worth making selections, locally, from this.

The Seraup planted in the deeper portion of the area all gave fairly good yields; while the poorest yields amongst the short term varieties were recorded for R. 4 and R. 7 whose maturation periods are slightly longer than those of the other Radins; being planted in the higher portion they were consequently more affected by the shortage of water in January.

TABLE XI.
Results of Varietal Trials at Bruas.

Strain	Maturation period days.	Mean yield per 1/40 ac plot in lbs.	Mean yield per acre in lbs.	Significance
Local Radin	177	55.9	2236	Less than control " " " " " " " " " " " " " " "
Mayang Ebos 201	206	46.5	1860	
Radin 2	201	42.0	1680	
Serendah F.S. 741	198	40.3	1612	
Nachin F.S. 27	197	36.2	1448	
Radin 13	205	34.5	1380	
Radin 7	210	27.8	1112	
Radin 4	210	26.1	1044	
Significant difference between mean yields per plot = 6.34 lbs.				
Seraup 36	223	53.71	2148	Nil
Seraup 15	221	51.67	2067	"
Local Seraup	230	48.29	1932	—
Seraup 1	224	47.10	1884	Nil
Significant difference between mean yields per plot = 7.80 lbs.				

In Batu Kurau Mukim near Taiping, a compilation of results derived from the distribution of selected seed, showed that Seraup 36, which is well established in the mukim, still produces very satisfactory crops, since, of 28 measurements, 24 showed substantial increases over the crops derived from local, unselected padi.

Glugor Test Plot, Penang.

At the Glugor Test Plot in Penang, the past season was ideal as far as weather conditions were concerned and in consequence, growth was robust and tillering good. Rats, however, were very destructive, and some stem borer damage also occurred. At this Test Plot, 9 selected strains of padi were tested for yield against the best, local popular variety (Sekapoy) as a control, and each variety was planted in 6 randomised blocks. Water control, which has been greatly improved on this area, was excellent throughout the season.

Rat damage was, however, very severe in nearly all the early planted plots of late maturing types and was variable in the later planted plots of varieties of shorter maturation periods, so that results are not truly comparable and will not be given, but fair average crops were harvested from Radin 4, R. 13, R. 2, Siam 29 and from the two early ripening types Radin Siak and Nachin F.S. 27 which both showed strong straw characters.

In order to test the possibility of obtaining two crops of early maturing varieties of padi from the same land within twelve months, as a method of increasing local production of padi, "double-cropping" experiments were started at this station on suitable land, that is, where control of water supply and drainage is as satisfactory as possible.

In 1930 in the normal padi season a good crop of each variety tried was obtained, the inter-season crop was, however, damaged by floods and had not matured when it was time to prepare the land again for the next season. The plants were, therefore, cut down and this season's crop was planted immediately.

Six varieties and strains were tried, in duplicate plots.

The season was a good one and yields obtained were satisfactory.

TABLE XII.
Results from Varietal Trials at Glugor.

Strain	days Maturation period :	Yield per acre Calculated average in lbs.
Siam 29	199	2,430
Radin 2	208	2,220
Serendah 824	198	2,070
Nachin F.S. 27	192	1,980
Radin Siak F.S. 10	184	1,970
Nachin 10	202	1,960

Siam 29 and Radin 2 gave the best crops, but these varieties having over six month maturation periods, under Glugor conditions, would require that the second crop nurseries should be prepared in advance of harvesting of the first crop to allow time for harvesting and preparation of land between crops.

Radin Siak has a shorter maturation period than the remainder and has strong straw, this may prove to be the most satisfactory variety.

The inter-season crop, planted in March, was again a failure owing to flood damage, in spite of improvement in the drainage facilities.

Test Plots in Kedah.

In conjunction with the work of the Teluk Chengai Experiment Station, four temporary test plots, distributed in representative padi areas, were planted last season with selected strains and local popular varieties were used as standards for comparison.

Land, in each case, was merely rented in order to gauge its value for use before permanently designating it as a Test Plot. Tests were made in replicated plots of 44 x 22 feet in each area.

Jitra.

This area comprised 3.3 acres and had the advantage of irrigation water which is led by a canal from a dam in the Jitra river: though this was counter-balanced by the depredations of land crabs. Three selections were tested against the average of three local popular varieties in 5 "chess boarded" replications.

Nachin 10, with an average yield of 3,100 lbs. per acre was found to be significantly better than the controls.

Langgar.

This station contained 2.4 acres. Three selections were tested against the average of 3 local popular types. Again Nachin 10 with a yield of 2,394 lbs per acre proved to be significantly better than the other types, while Siam 29, just out-yielded the controls, which averaged 1,964 lbs. per acre. In this locality Siam 29 was favoured as an eating rice more than Nachin 10 which was not considered to be very palatable.

Sala Kanan.

This area of 2.1 acres is irrigated by a dam in the drainage canal, it is representative of recently cleared "gelam" land* and was prepared for planting by the "tajak"†. Three late maturing selections were tried against the local popular variety, Mayang Ebos, in 5 "chess boarded" replications. Seraup 15 gave a yield (2,413 lbs. per acre) significantly better than the controls (2,022 lbs.).

Rantau Panjang.

The area of this station is 3.5 acres. Very adverse conditions, (flooding drought, and pests) rendered results of no value, although there were indications that the local varieties produced better crops than the three selections which were planted. (Radin Strains nos. 2, 4 and 13).

TABLE XIII.
Results of Varietal Trials on Test Plots in Kedah

Test Plot	Strain	Maturation period : days	Average Yields in lbs.		Significance over Control
			Per Plot	Per Acre	
Jitra	Nachin 10	188	68.5	3,100	Better
	Radin 2	188	50.6	2,268	Poorer
	Radin 13	188	51.1	2,289	Nil
	Controls	188	54.2	2,444	
Significant difference between average weights per plot = 3.5 lbs.					
Langgar	Nachin 10	188	53.3	2,394	Better
	Siam 29	185	43.9	1,989	Nil
	Radin 2	183	40.0	1,792	Poorer
	Controls	183	43.5	1,964	
Significant difference between average weights per plot = 3.0 lbs.					
Sala Kanan	Seraup 36	213	58.6	2,629	Nil
	Seraup 15	221	54.4	2,413	Nil
	Radin 7	200	57.1	2,545	Better
	Controls	209	45.1	2,022	
Significant difference between average weights per plot = 10.1 lbs. (for Seraup 36 = 15.9 lbs.)					

* Secondary jungle land on which a preponderance of *Melaleuca leucadendron*, or the Kajeput oil tree, is found.

† An instrument somewhat resembling a short, heavy bladed scythe, used for cutting down weeds at ground level.

Though Nachin 10 and Siam 29 suffer from the defect of weak straw, the dry harvest counteracted this fault and little loss of grain was sustained. The harvest in Kedah is usually dry, but even so, these types of padi should improve in value if their straws can be strengthened by crossing with suitable varieties. At each of the Test Plots where crops matured under normal conditions, at least one selected type of padi was found to be significantly superior to the best local, popular varieties, while at Sala Kanan, all three tested selections gave materially better crops than the controls. Consequently a demand for selected seed has developed in the neighbourhood of these plots and much interest is shown in the tests.

Perlis Test Plots.

Two Test Plots (Arau and Sanglang) were planted in the past season and the results indicated better yields from one of the local unselected varieties as shown in the summary below :

TABLE XIV.
Results from Trials with Padi Radin and Local Strains in Perlis.

Strain	Average Yields in Gantangs		Approx. Equivalent in lbs.
	Per Plot	Per Acre	
Radin 13	9.25	405	2,400
Radin 2	8.50	383	2,250
Radin 4	8.25	371	2,200
Reyong	10.50	473	2,800
Kunchor	8.50	383	2,250

Part II.

MANURING

BY

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Manurial trials were continued at Titi Serong, Pulau Gadong and Talang and in addition were carried out at Bukit Merah and Telok Chengai.

Telok Chengai, Kedah.

The lay-out on this station followed that described for the Federated Malay States and Straits Settlements Stations for the season 1930-31; there were eleven treatments which, like the controls, were replicated 6 times, arranged in 6 half-blocks grouped into 3 blocks. Two pedigree strains Radin 2 and Radin 13 were grown.

The area consisted of nearly level clay alluvium which had been under continuous cultivation with padi for many years. It was not irrigated, the crop being dependent on rainfall, of which there was 56 inches from July to December. Except after heavy rain there was little water movement. In the previous season the trial area, like the rest of the station, received a dressing of Kedah bat-guano (containing 17 per cent. P_2O_5) at the rate of 1,000 lbs. per acre, but no manure had been applied for several years previously and the padi straw had been burnt off each season after harvest.

Plots were $1/45$ acre ($1/32$ relong) in area with sufficient border space to eliminate bund effect. The land was prepared for planting by local methods *i.e.* it was ploughed, harrowed and rolled in a wet condition, the operation of harrowing being repeated until all grass and weed growth had disappeared.

Seeds were sown in a wet nursery on July 18th. Manures were applied on September 1st, transplanting done on September 7th and the plots flooded to a depth which did not exceed 2 inches. 3--4 plants per hill were planted, spaced roughly at 14×18 inches. By September 12th, the depth of water had reached 6 inches. At the end of October, vegetative growth exhibited striking differences, plots with nitrogen and phosphorous from artificials were mostly good, while the control plots and those treated with potash were definitely poor. Growth on the other plots showed considerable variation.

Flowering was general by December 12th and water was gradually drained off after this date. Harvesting was commenced on January 24th and completed on January 27th.

A few plots were damaged by storm and have been excluded.

Recording of yields was by weight; the volume yields given below have been calculated from the specific gravity of bulked samples. For convenience of comparison with stations in the Federated Malay States and Straits Settlements, yields have been recalculated to $1/40$ acres.

There were no significant differences between the yields of the two strains, nor in the results from identical quantities of Nitrogen and Phosphorous applied as ammonium sulphate and superphosphate, or as "ammonium phosphate"—these have therefore been taken together in the following table.

The numbering of treatments follows that of last year's trials.

TABLE I.
Results of Manurial Experiments at Telok Chengai, Kedah.

Treatment	Manure	Quantity per acre of Nutrients		Lbs. per 1/40 ac.	Gantangs per acre	Average No. of Tillers at harvest
		N	P ₂ O ₅			
I	Ammonium phosphate or sulphate of ammonia and super-phosphate	12	15	57.5*	405	17
II	"	25	30	63.0†	440	18
III	"	12	41	63.2	445	17
IV	"	24	82	62.9	440	18
V	"	6	37	62.7	440	17
VI	"	12	73	66.1	465	18
VII	" + potassium sulphate	12	41+19K ₂ O	55.0†	385	16
VIII	" + Kainit	12	41+70K ₂ O+ 35MgO	60.6	425	16
IX	Kedah phosphate	0	30	55.0	385	16
X	" "	0	60	62.7	440	17
XI	" " + Am. sulphate	12	30	62.5†	440	16
XII	Control			56.2	390	16

The minimum differences between the means of any pairs of treatments for 'significance' of $P = .05\ddagger$ are 5.5 lbs. in the case of a treatment of 5 or 6 replicates compared with one of 6 replicates and 6.7 lbs. in the case of 4 or 5 replicates compared with 5.

On this basis all treatments except I, VII, VIII and IX, have given 'significant' increases while the effect of potash in VII has been to neutralise the good effects of N/P in III. The addition of magnesium salts appears partly to overcome the ill effects of potash.

It would appear from the fact that treatment X gives increases, while treatments I and IX do not, that the main limiting factor is phosphorous, which must exceed a limiting concentration before increases can be obtained. The heavy, basal dressing of phosphate given a year ago, has to be borne in mind as without it there is a probability that the control plots would have been poorer, and greater increases on those manured have been shown.

* Two plots discarded.

† One plot discarded.

‡ 'Significance' of $P = .05$ is a short method of expressing the mathematical fact that the odds are 20 to 1 against the attainment of the given value or values by chance, i.e. there is a considerable measure of certainty that manuring has been responsible for the increase found.

Separate experiments gave no significant differences for chelluped* over non-chelluped plots.

Bukit Merah Province Wellesley.

The experiments were carried out at the Departmental Experimental Station at Bukit Merah and were laid in a modified Latin Square with four replications consisting of a double row of plots thus:—

B	D	C	A	C	A	B	D
A	B	D	C	D	C	A	B

Plots were of an area sufficient to give a reaped portion 1/40 acre in extent, with a border to eliminate bund effect. Weeds were first cleared in the middle of June—ploughing commenced on 24th June and was followed by a second ploughing, raking and rolling after a month's drought.

Seed was sown on 26th July and transplanted on 3rd September. Flowering started on 8th January and reaping on 22nd February. Weather conditions during the growing season were ideal.

TABLE II.
Results of Manurial Experiments at Bukit Merah.

		Lbs. per 1/40 ac.	Gantangs per ac.	Average No. of Tillers.
A.	Nursery manuring with mm. phosphate 300 lbs. p.a.	51.6	352	21
B.	Chellupping with bone meal	52.0	361	20
C.	Field manuring am. phosphate 100 lbs. p.a.	57.3	395	22
D.	Control	47.1	328	20

Pedigree strain S.K. 36 was employed.

The figure for increase over control (significance $P = .05$) is 2.6 lbs. or 15 gantangs and for difference in either direction 3.2 lbs. or 18 gantangs.

The arrangement adopted gave very considerably enhanced accuracy in this case, although theoretically it is not ideal.

All treatments are thus seen to have been significant.

Titi Serong (Krian, Perak) Talang (Kuala Kangsar, Perak) & Pulau Gadong (Malacca.)

The experiments were on the same areas as those of the previous season and arrangements were made to ascertain whether there was residual effect. There were replications of each treatment arranged in blocks; "treatments" I—VI were so arranged that they included two replications each of last season's treatments Nos. I—III, V, VI and VII, which at that time gave no significant differences among themselves. Treatments VII—XII were on last season's plots, VII—IX having this year repeat additions of manure, and VI, X—XII having no manure this year; X was the control in both seasons. By comparing this season's yields from treatments I—V with VI, XI and XII, the effect of the

* 'Chellupping' is the practice prevalent in Malacca of dipping the roots of seedlings at the time of transplanting in a paste of bone meal and water.

new treatments on land manured last season may be obtained, by comparing XI and XII with X, residual effect from last season may be obtained.

Seasonal dates and kind of padi used were as follows:—

		<i>Titi Serong</i>	<i>Talang</i>	<i>Pulau Gadong.</i>
Sowing of seed	...	10. 8.31	23.8.31	22.6.31
Transplanting to field	...	17.10.31	27.9.31	5.8.31
Flowering	...	1. 1.32	5.1.32	?
Harvesting	...	17. 2.32	13.2.32	16.1.32
Kind of padi	...	Radin 2	Radin 2	Siam 29

TABLE III.
Results of Manurial Experiments at Titi Serong.

Treatment	1931 — 32 Yield			1930 — 31	
	Lbs. per 1/40 ac.	Gantangs per acre*	Average Tillers at harvest	Treatment	Gts. per acre
I Nursery manuring at the rate of N 39 lbs. P_2O_5 144 lbs. per acre with ammonium phosphate	43	300	12	Various manurial mixtures	379
II Nursery as in I and field manuring P_2O_5 35 lbs. per acre with superphosphate	42	290	11		
III Chellupping with bone meal	45	310	11		
IV Cyanamide and basic slag N 12 lbs. P_2O_5 40 lbs	49	340	11		
V Ammonium phosphate, kainit lime=N 13 lbs. P_2O_5 48 lbs. K_2O MgO CaO 70 lbs.	45	310	12		
VI No manure	54	370	12	same	250
VII Ammonium phosphate N 24 lbs. P_2O_5 82 lbs.	47	320	12		
VIII Ammonium sulphate and superphosphate N 12 lbs., P_2O_5 73 lbs.	43	290	12		
IX Perlis phosphate = 92 lbs. P_2O_5	41	280	12		
X Control	48	330	11		
XI No manure	—	—	Perlis phosphate = 46 lbs. P_2O_5	same	366
XII No manure	—	—	Perlis phosphate and ammonium sulphate N 121 lbs., P_2O_5 46 lbs		

* Calculated from weights.

There has clearly been no response to manuring, nor has there been any residual effect.

Owing to a misunderstanding, results from "treatments" XI and XII could not be obtained; in their place was tried a mixture of wood ashes 40 lbs. ammonium sulphate 40 lbs. fish guano 100 lbs. superphosphate which gave a yield of 44 lbs. per 1/40 acre or 300 gantangs per acre.

Talang.

The experimental area was submerged for some days during the considerable floods of December and the most forward plots (those which had received nursery treatments) suffered to some extent.

A number of plots were attacked by *bena puteh* (*Sogata furcifera*) but this did not appear seriously to affect the yield.

TABLE IV.
Results of Manurial Experiments at Talang.

Treatment	Yield 1931 — 1932			Yield 1930 — 31
	Lbs per 1/40 ac	Gantangs per acre	Average Tillers at harvest	Gantangs per acre
I Nursery manuring at the rate of N 39 lbs P_2O_5 144 lbs per acre with ammonium phosphate	52	378	12	389
II Nursery as in I and field manuring P_2O_5 35 lbs. per acre with superphosphate	53	352	14	
III Chellupping with bone meal	56	407	18	
IV Cyanamide and basic slag N 12 lbs. P_2O_5 40 lbs.	63	442	14	
V Ammonium phosphate, kainit lime = N 13 lbs P_2O_5 48 lbs. K_2O MgO (aO) 70 lbs	66	458	16	486
VI No manure	54	371	14	
VII Ammonium phosphate N 24 lbs P_2O_5 82 lbs.	73	509	18	
VIII Ammonium sulphate and superphosphate N 12 lbs., P_2O_5 73 lbs.	70	476	16	
IX Perlis phosphate = 92 lbs. P_2O_5	73	508	15	408
X Control	44	332	12	247
XI No manure	63	466	15	326
XII No manure	58	423	14	407

Significant increases over a control for $P = .05$ are 6.4 lbs. or 44 gantangs*; and for differences in either direction 7.7 lbs. = 53 gantangs.*

Comparing VI, XI and XII with X it is clear that last season's applications have had a marked positive effect this season; comparing IV and V, VII—IX with VI, there has been a significant, but not invariably large, increase as a result of this season's application. Neither the basic, nor the complete mixtures IV and V, have produced larger increases than VII to IX, but it must be remembered that the yields of the three latter treatments were higher last season than the mean of those on which IV and V are superimposed.

Owing to flood damage it was impossible to judge the effects of nursery treatments.

Pulau Gadong.

The weather throughout was satisfactory. Some of the manurial plots were attacked by stem borer which slightly reduced the yields; others in block C were badly attacked by rats—the former have been included the latter excluded, from the following table :—

TABLE V.
Results of Manuring Experiments at Pulau Gadong.

Treatment	Yield 1931—1932			Yield 1930—31
	Lbs. per 1/40 ac.	Gantangs per acre	Average Tillers at Harvest	Gantangs per acre
I Nursery manuring at the rate of N 39 lbs. P_2O_5 144 lbs.	65	460	19	355
II Nursery as in I and field manuring P_2O_5 35 lbs. per acre with superphosphate	65	470	19	
III Chellupping with Perlis phosphate	69	500	18	
IV Cyanamide and basic slag N 12 lbs. P_2O_5 40 lbs.	62	460	17	
V Ammonium phosphate, kainit, lime = N 13 lbs. P_2O_5 48 lbs. K_2O MgO CaO 70 lbs.	59	430	15	
VI No manure	64	460	18	315
VII Ammonium phosphate N 24 lbs P_2O_5 82 lbs.	63	460	18	
VIII Ammonium sulphate and superphosphate N 12 lbs., P_2O_5 73 lbs.	65	450	19	
IX Perlis phosphate = 92 lbs. P_2O_5	65	480	18	373
X Control	60	410	17	323
XI No manure	61	450	18	324
XII No manure	61	440	16	340

* Calculated from yield in lbs.

Differences which would have significance $P = .05$ are for an increase over a control 4.8 lbs. or 33 gantangs* or in either direction 6.1 lbs. or 43 gantangs.*

The striking discrepancy between the weight and measure of the control (X) is probably another illustration of the difficulty of measuring accurately small quantities of padi.

Taking weights as the more accurate measurements and comparing VI, XI and XII with X, no residual effects appear; comparing I to V with VI, there is a possibility that chellupping has effected some improvement.

Summary of Results.

These are very similar to those of last year and tend to show that each station, for a particular season, has a maximum beyond which manuring with artificial fertilisers cannot increase the crop. Where, as in Kedah, Province Wellesley and Malacca, this maximum is comparatively near to the normal yield, small increases are obtained; where it is far above the normal, as at Talang, large increases are obtained.

No deductions can be drawn from results at Titi Serong as there was a complete absence of response.

Taking the value of one gantang of padi at 10 cents we have:—

	Telok Chengai	Bukit Merah	Talang	Pulau Gadong
Increase over control — gantangs per acre	+ 50	+ 60	+ 130	+ 35
Increased monetary return \$† per acre	5	6	13	3 50

Since the cheapest field dressing (400 lbs. per acre) of Perlis phosphate, costs approximately \$4/—, it is clear that only at Talang could manuring be recommended for a monetary return in one season—which is the only type of return likely to appeal to cultivators unaccustomed to manuring; actually, it must be remembered that Telok Chengai had received in the previous season a large, basal dressing of phosphatic fertiliser which may have obscured response.

While residual effect is marked at Talang it is absent on a commercial scale at Malacca.

There remains the question of cheaper forms of manuring, such as nursery application or chellupping—in Kedah chellupping had no effect, in Malacca it gave an enhanced yield just on the borders of significance; at Talang and at Bukit Merah positive increases were obtained and the former would probably have been higher in the absence of flood damage. Nursery manuring was less beneficial.

These results shed no light whatever on the reason or reasons for the existence of the "bar". Reference to Table III page 613 shows that the soil at Talang is richer in nutrients than at Pulau Gadong or at Titi Serong and, it might be argued, that there alone is the general level of plant food sufficiently high to

* Calculated from yield in lbs.

† \$1 = 2s. 4d.

permit the relatively small quantity of some one nutrient added as manure to have any effect. This view is, however, rendered difficult of acceptance by the fact that it is precisely at Talang that the controls have for two seasons exhibited the smallest values.

The remarkably low tillering at Titi Serong and Talang does not help in the search for an explanation since at the former, response to manuring is poor and at the latter, high.

Correlations were worked out between manuring, tillering and yield for Kedah and it was found that while there was some positive correlation between manuring and tillers, there was none between tillering and yield—in other words increases have occurred in both tillering and yield but without causal connection. Inspection of the tables for other stations leads to similar conclusions.

Manurial Experiments 1932-1933.

Whatever the cause, it seems useless to continue on orthodox lines—previous experiments and those of the last two seasons all show that no increase beyond the "bar" will be obtained by such methods. We have now to enquire whether manures will aid the soil (if aid is needed) in supporting more plants per unit area, i.e. to test the possibility of obtaining greatly increased yields by manuring and closer planting. There is the greater possibility of this as in Italy, yields of 800 gantangs per acre are obtained with planting distances of 8 ins. x 8 ins.

It is fortunate that examination of the results of subdivided 1/40 acre plots has shown that experimental error is not greatly increased by reduction of area to 1/120 acre and thus the proposed complex experiment may be carried out without increasing necessary area or labour.

It is proposed to test (*a*) chellupping, (*b*) phosphorus, (*c*) nitrogen and phosphorus and (*d*) control with 3 planting distances—arranging the manurial treatments in 1/40 acre plots with 4 replications in a Latin Square and subdividing the plots into three sub-plots of different planting distances of 1/120 acre each. The greatest planting distance and number of plants to a hole will be that current in the district and the other two distances should be 3 ins. x 3 ins. and 6 ins. x 6 ins. less than this.

A small subsidiary experiment to test the effect of cattle manure and of very large applications of artificial nitrogenous fertilisers has also been laid down.

Part III.

EXPERIMENTAL ERROR OF FIELD TRIALS

BY

W. N. C. BELGRAVE,
Chief Research Officer.

The standard area harvested in padi experiments in Malaya has been in the past 1/40th acre. This necessitates provision of considerable areas for experimentation when due allowance is made for minimum breadth of 6 feet around each harvested portion. Steps were taken last season to ascertain whether smaller areas, comparable with those employed in Ceylon, would not suffice. The central 1/40th acre portion of the control plots in the manurial experiments described in Part II of this article, together with similar plots on the Padi Test Stations at Dong in Pahang, Selinsing and Lenggong in Perak, were divided at harvest into nine equal sub-plots of 1/360th acres in extent, and the yield of padi separately recorded from each sub-plot (with the exception of Telok Chengai where the 1/45th acre plots employed were divided into eight sub-plots). It is fully realised that the experimental error of sub-plots so found is not exactly comparable with the 1/40th acre plots since the latter are provided with bunds and slight differences of water supply might considerably increase experimental error. On the other hand, consideration of the error of varietal trials where separate bunds are not invariably provided, does not suggest that this disturbing factor is large.

Sub-plots were numbered 1, 2, 3 and the yields have been combined and

4, 5, 6
7, 8, 9

statistically treated in different ways—three sub-plots of 1/120th acre and one of 1/90th acre to each plot have been obtained by combining (a) 1/360th acre yields into three rows or columns (whichever gave the *greater* variation in order to provide as rigorous a test as possible) and (b) the four yields of sub-plots No. 1, 2, 4, 5.

Sub-plots at Telok Chengai were numbered

1	2
3	4
5	6
7	8

and were combined either 1, 2, 3, 4 etc. or 1 2 3 4, 5 6 7 8.

The sub-plots or their combinations were also treated as (a) completely randomised, (b) restricted in blocks (c) in the case of the 1/360th acre results, arranged in Latin squares.

The usual number of replications of 1/40th acre plots was six.

Standard deviations expressed as percentages of yield are given below and show that on the whole it is justifiable to expect that no great degree of accuracy

would be lost by reducing the size of plots to 1/90th acre completely randomised, 1/120th acre restricted in blocks or 1/360 in Latin squares. (Table I).

The unit for the general manurial experiments described in Part II for the season 1932—33 has been taken as 1/120th acre and results will confirm or disprove the suitability of plots of this size for experimental work in Malaya. Although it would appear possible to employ plots of 1/360 acre, this has not been done as results might completely be spoilt by slight and possibly unnoticed, insect or rat damage.

Details of yields and the statistical working for one station are given in Table I.

TABLE I.

Pulau Gadong.

Yields in Kilos. of 1/360 acre sub-plots.

Plot I.	2.98	3.08	3.00	II.	3.11	2.90	3.28
	2.78	3.20	3.38		3.90	3.41	3.69
	3.50	3.28	3.38		3.94	3.25	3.25
III.	3.12	3.01	3.17	VI.	2.77	2.83	3.08
	3.47	3.01	3.25		2.98	2.38	2.66
	3.73	3.15	3.30		2.44	2.36	2.77
V.	3.19	3.05	3.19	IV.	2.83	3.24	2.98
	3.72	3.22	3.09		2.69	2.80	3.03
	3.37	3.09	2.76		2.64	2.61	2.68

<i>Completely Randomised</i>	<i>1/360 acre</i>	<i>1/120 acre</i>	<i>1/90 acre</i>	<i>1/40 acre</i>
Sum squares	... 6.5484	13.9482	4.3189	28.3662
Degrees of Freedom	.. 53	17	5	5
Variance	... 0.124	0.821	0.864	5.675
Standard Deviation	... 0.351	0.906	0.929	2.38
Mean	.. 3.08	9.24	12.28	27.72
S.D. as percentage of mean	... 11.4	9.8	7.6	8.7
<i>Taken in Blocks</i>	<i>1/360 acre</i>	<i>1/120 acre</i>		
Sum squares	... 3.3966	4.4928		
Degrees of Freedom	... 48	12		
Variance	... 0.0708	0.374		
Standard Deviation	... 0.264	0.611		
S.D. as percentage of mean	... 8.6	6.6		

1/360 acre taken in Latin squares.

		Sum of Squares	Degrees of Freedom	Variance	Standard Deviation
Total within Blocks	..	3.3966	48		
Rows	...	1.4976	12		
Columns	...	1.1322	12		
Residue	...	0.7668	24	0.0319	0.178

Standard deviation as percentage of mean = 5.8 per cent.

TABLE II.
Standard deviations expressed as percentages of means.

STATION	Randomised			Taken in Blocks		Taken in Latin Squares 1/360 acre
	1/360	1/120	1/90	1/360	1/120	
Pulau Gadong	11.4	9.8	7.6	8.7	8.6	5.8
Bukit Merah	11.2	8.0	6.5	6.2	9.9	7.1
Titi Serong	15.8	13.4	7.4	11.1	12.7	9.1
Talang (Unmanured)	18.3	10.2	11.4	6.7	18.1	12.5
" (Manured)	21.8	19.1	10.5	13.3	16.6	12.6
Dong	12.0	7.5	5.5	3.6	12.2	12.4
Selinsing	21.3	16.5	14.1	11.8	18.9	14.9
Lenggong Radin	18.9	16.1	16.5	9.0	17.1	11.1
" Seraup	17.8	15.1	18.5	15.2	13.2	14.1
Kedah	10.5	7.6	7.0	6.4	9.2	4.4

Part IV.

EXPERIMENTAL PADI TANKS

BY

W. N. C. BELGRAVE,

Chief Research Officer.

In view of the necessity for rigidly controlled conditions in the study of many problems affecting the padi plant, a series of 50 tanks was constructed at the Government Experiment Plantation, Serdang, in 1929. Tanks are 6 feet x 4 feet x 2 feet 6 inches deep built with bricks, faced with Portland cement and sunk in the ground at a depth of 2 inches. Each tank is provided with water supply, is capable of separate regulation and with an overflow pipe by which the level of standing water can be regulated. At the bottom of each tank is a drain pipe communicating with an outflow provided with a tap so that when and if necessary the effects of percolation as opposed to surface drainage may be studied. The tanks are enclosed in a cage of $\frac{3}{4}$ inch mesh wire netting to exclude birds and rats. Construction of the installation was supervised by Mr. T. D. Marsh, Assistant Agriculturist.

For the first crop of padi the tanks were filled with a clay loam of quartzite formation taken from a cleared hillside, as it was desired to ascertain the requirements for conversion of ordinary inland soils into good padi land. The soil, although light in texture in comparison with the familiar Krian clay, is, nevertheless, representative of many padi areas.

The first crop was a complete failure, even in tanks which had received liberal applications of artificial fertilisers; seedlings grew well but shortly after transplanting they became yellow, the leaves shrivelled and the plants died. Considerable algal film was formed on the surface of the water.

The second attempt in 1930 met with failure, although the plants survived rather longer, and it was then considered that the possible low content of organic matter in the soil might account for the poor growth. Accordingly, the tanks were divided into three series; in the first *Crotalaria anagyroides* was planted; in the second *Mikania scandens* while the third was left bare. Meanwhile three tanks were filled with padi soil brought from Krian and produced an excellent crop of padi, thus proving that failure of the earlier attempts was not due to some inherent defect in the technique but rather to some deficiency in the soil employed. In the early part of 1932 a third attempt to grow a crop of padi was made. Each of the three series of tanks was divided into groups to which the following treatments were applied :—

- (a) Nothing.
- (b) Sulphate of ammonia and basic slag at the rate of 100 and 150 lbs. respectively per acre.

CROTALARIA



Control

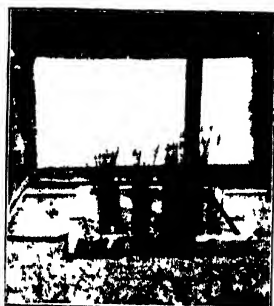


Artificial



Cattle

MIKANIA



Control



Artificial



Cattle

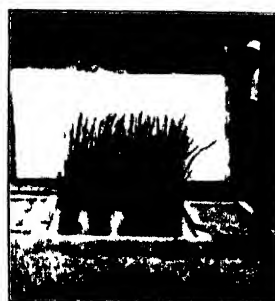
NO COVER



Control



Artificial



Cattle

(c) As in (b) with the addition of cattle manure at the rate of 4 tons per acre.

(d) Krian padi soil 20 lbs. per tank.

The object of applying Krian soil was to supply possibly lacking elements of the bacterial flora.

The green matter grown in the tanks was turned in and all treatments, except ammonium sulphate, were given three weeks before transplanting, ammonium sulphate was added two weeks later.

Shortly after transplanting, differences in growth manifested themselves between the different groups and treatments which persisted throughout; in the best tanks there was excellent setting of seed and every prospect of a good harvest. Unfortunately the harvest was lost owing to a severe attack of insect pests, a frequent penalty for growing small isolated patches of grain crops. The results could therefore be judged only by appearance; at intervals throughout the growing period the plants were classified by eye. An example follows.

**Classification of growth and appearance taken three months after
transplanting Padi in Tanks receiving different
Manurial Treatments.**

		very poor	poor	medium	good	very good
<i>Crotalaria</i>						
Control	...		1	2		
Artificial	...				1	2
Cattle	..				1	2
Krian	...				2	1
<i>Mikania</i>						
Control	...	2	1	2	1	1
Artificial	...				3	1
Cattle	...				3	
Krian	...		1	2		
<i>Bare</i>						
Control	...	4				
Artificial	..			3	2	
Cattle	.	4			2	1
Krian	..					

This classification is, of course, valid only for this particular experiment and in fact "good" here was equal to "fair" in an average field and "very good" to "good". Plate 1, showing the padi just after ear formation, gives a general idea of growth.

The nitrogen content of the *Crotalaria* when turned in, was approximately 3 per cent. and that of *Mikania* only 1 per cent. and it is clear that the crop which was richer in nitrogen has been more effective than the poorer one and that both have given better results than with no green matter at all. The interaction between green matter and manure is striking; manure did well in every case but clearly exercised maximum effect only in the presence of *Crotalaria*.

These experiments indicate the desirability of turning in quantities of green matter as an aid to the rapid "conditioning" of new land for rice growing, more especially if that land has not previously been flooded for long periods. There remains the question of the best time of turning in and of the possible inter-relationships between manure and green matter on established padi fields.

Previously, departmental work showed no increase of yield following the incorporation of excess green matter, with or without fertiliser, in old padi fields but it is possible that the green matter was turned in too early (cf. recent work in Ceylon). Further experiments with the tanks to determine the best time of incorporation are in progress.

Abstract.

TWELFTH REPORT ON NATIVE RUBBER CULTIVATION.

Third Quarter 1932.

*Prepared by the Bureau of Agricultural Economics of the Division
of Agriculture of the Netherlands Indian Department of
Agriculture, Industry and Commerce, at Buitenzorg,
Java, November, 21, 1932.*

The general advance in prices is noted, the reason assigned for this improvement being (a) the heavy consumption of rubber in the United States during June; (b) the increasing consumption of rubber in countries other than the United States; (c) the slowly decreasing exports from the producing countries; (d) the discovery of errors in estimating world stocks, which resulted in stocks being lower than was believed to be the case; (e) the general spirit of optimism engendered by the international conferences at Lausanne and Geneva.

This substantial improvement in prices has resulted in increased production and exports of native rubber in Netherlands India

The total exports of native rubber (dry equivalent) from the Outer Provinces to foreign countries for the first three quarters of 1932 in metric tons were as follows:—first quarter 15,942, second quarter 10,613, third quarter 14,432, a total of 40,987 tons as compared with corresponding figures for 1931 of 23,160, 23,551, and 21,029 a total of 67,740 tons. In the first three quarters of 1930 the exports were 72,322 tons and in the corresponding period of 1929 they were 82,911 tons.

In addition, the preliminary reports from the five leading export centres for native rubber shew a further sharp increase for the month of October, being 6,923 metric tons, as compared with 5,419 metric tons in September and 5,615 metric tons in August. Had not the rise in price of rubber coincided with the padi planting season which absorbed considerable labour, an even higher production of rubber would have resulted.

The following are amongst the pertinent observations extracted from the various native rubber reports.

Acheen and Dependencies. The increased price resulted in a noticeable increase in production in the country about Langsa during September. While in August all the tapping was performed by family labour, during September tapping was done by outside labour according to the "bagi dua" system whereby half the rubber goes to the tapper and half to the owner of the trees; or by the "bagi tiga" system when two-thirds of the rubber becomes the property of the tapper. In some of the larger holdings tappers were hired for wages. The owners of these plantations did this as a speculation with the hope of seeing a further increase in prices and they therefore held on to their rubber.

Statistics were collected regarding tapping on small holdings. On an average, it appears that one man tapped about 360 trees per day; the average

daily production per tapper was about 5.4 kati (7.4 lbs.) of slab rubber; each tapper worked about $4\frac{1}{2}$ hours in order to secure this average production.

Langsa is at present the only place where rubber is being bought up. Therefore, it is around this market that holdings are being exploited. Under existing prices and considering transport costs, it would not appear likely that holdings more than ten kilometres distant from Langsa will be exploited.

Sumatra West Coast. Tapping activities varied with the price of rubber. During the third quarter 3,051 piculs of slab rubber were shipped out of the province from Bang Kinang to Pekan Baroe, while from Batang Hari a total of 835 piculs were shipped to Djambi.

In addition to family labour, the "bagi dua" system was employed. In some cases, the tapping coolies received the entire amount of rubber which they produced because the owners desired to retain the labour in the hope of possible price increases.

Taparoei. There was practically no tapping in July and August. More interest was displayed, however, in September owing to the further advances in the price of rubber. In spite of the price decline at the end of September, it is expected that October exports will show a decided increase over preceding months.

Palembang. Heavy increase in exports followed the higher prices at the end of August and beginning of September.

Western Division of Borneo. Exports increased and reached the peak in the first quarter of 1932. Larger export was partly due to the shipping of old stocks. The want of cash among natives is so great and the opportunity for securing money so small that each and every increase in prices will witness an increase in the production of rubber.

Southern and Eastern Division of Borneo. The great increase of export in August and September must be ascribed entirely to the increased tapping as a result of the higher prices.

The revival of the rubber trade immediately affected the entire economic life of the Hoeloe Sungei division. In August and September the markets were crowded. Large quantities of small pails, knives, cups etc. were again supplied. The prices of water buffaloes sold in Pleihari to Hoeloe Soengei rose with the rubber prices. In the sub-district of Tandjoeng it was requested in a few kampongs that school time be changed again to the afternoon so that children could do tapping work in the morning.

Tapping was performed almost entirely by family labour. The large holdings have not yet been taken into tapping.

Outside the Hoeloe Soengei area, although a little later, increased tapping was recorded.

Reviews.

Cacao.

BY

C. J. J. VAN HALL.

Second Edition. 504 pages and index; 176 illustrations.

Macmillan & Co., Ltd., London, 1932. Price 28 shillings.

The appearance of a second edition of Dr. van Hall's important book on the cacao industry, originally published in 1914, is opportune. In combination with other major tropical crops, recent research has resulted in considerable additions to knowledge regarding cacao, its cultivation and production.

The book is divided into eleven chapters dealing with the following subjects—history, origin and present distribution, chemistry, botany, varieties, cultivation, selection, preparation, pests and diseases, cacao growing countries and characteristics of marketable beans. The chapter dealing with selection is a new one and consists of a concise account of the comparatively small amount of work which has been done in this direction with cacao. In view of the increasing realisation of the importance of compatibility between stock and scion, the selection of cacao-stocks compatible with desirable scions might well have been suggested. All aspects of the cultivation of this crop are dealt with in considerable detail, such information being augmented by a description of the methods employed in the principal cacao-producing countries throughout the tropics. The general presentation of the subject matter and numerous illustrations combine in the production of an excellent agricultural handbook, invaluable to those interested in cacao cultivation.

Since Malaya is not a cacao-growing country it is unnecessary to review the subjects dealt with any degree of detail. It is of interest, however, to record the conditions obtaining in the cacao-producing districts of Ceylon and Java, where the average annual export is 4,000 and 1,200 tons, cacao respectively. As a comparison, mention should be made of the Gold Coast which exports 230,000 tons; some 44 per cent. of the world's production. Cacao is successful in Ceylon only between 500 and 2,000 feet elevation. The rainfall averages between 60 and 80 inches per annum. The soil is chiefly alluvial. The combination of rainfall, temperature, and elevation required for the profitable cultivation of cacao eliminates many districts for this product. Almost all the cacao produced is restricted to a comparatively small area centering round Kandy and Matale. In the Dutch East Indies cacao plantations are found principally in the regencies of Semarang, Soerakarta, and Pekalongan in Central Java. The estates are mostly situated on the slopes of mountains at altitudes ranging from 500 to 1,800 feet. A few

Note on the spelling of "Cacao":—The common Anglicised spelling *i.e.* Cocoa, is a corruption of the above and is now taken to refer to the powder made from crushed cacao seeds.—*Ed.*

estates occur at lower altitudes, near the sea-coast. The cacao trees suffer no ill effect from droughts of several weeks, often experienced during the months of July, August and September.

At the Experimental Plantation, Serdang, Selangor, several attempts by the Department to cultivate cacao experimentally have failed. Occasionally, however, individual trees are met with which have made comparatively good growth, and produce pods of fair quality. It appears doubtful, therefore, whether cacao might be grown with any real success on the plains in Malaya. The possibility of cultivating this crop on the hills at medium elevations is a matter worth investigating when the opportunity occurs.

J. N. M.

A Manual of Green Manuring.

Prepared by the Department of Agriculture, Peradeniya, Ceylon. 190 pages, 34 illustrations and figures. Price Rs. 5s, postage extra. Obtainable from the Manager, Publication Depot, Peradeniya.

The collection of a series of investigations, upon green manuring in Ceylon, published during recent years in the *Tropical Agriculturist*, and now issued as a separate manual, provides a valuable compendium of information to tropical agriculturists. The subject matter is divided into seven sections. Section I deals with the principles of green manuring and their application in Ceylon. Sections II to V are concerned with the use of green manures with the following major crops:—tea, coffee, cacao, rubber, coconuts, and padi. Further sections are devoted to fungus diseases of certain green manures and their relation to diseases in the main crop, and the more important insect pests by which green manures are liable to be attacked. Since the crops enumerated, with the single exception of cacao, are cultivated in Malaya, it is obvious that the experience of agricultural workers in Ceylon is likely to be of utility under similar circumstances in this country. In general, this is found to be the case. The list of references at the end of each section, facilitates detailed study of the particular subject where such is desired.

In Section I, an account is given of the advantages obtained in Ceylon from green manuring and their employment in other tropical countries. By the judicious use of green manures, including cover crops, the nitrogen and carbon contents of the soil are maintained, its physical condition and moisture-retaining capacity improved, and erosion prevented. The amount of nitrogen supplied to the soil by the employment of leguminous crops is shown to be considerable where abundant nodules are present. In cases where nitrogen is not increased, cover plants prevent loss of nitrogen as nitrates by leaching, in the early stages of establishment by the main crop. A legume providing an average crop of

4 tons of green material per acre per annum, containing .6 per cent. of nitrogen, will add to the soil at least 50 lbs. per acre of the latter. Local experience at the Government Experimental Plantation, Serdang, indicates that 4 tons of dry matter per acre is obtained from three-monthly prunings of *Crotalaria anagyroides* during the first year of its growth. With regard to the conservation of soil moisture, work at Peradeniya indicates that during the first two years growth of cover crops, an excess of surface moisture is lost through transpiration, but this is reversed once the cover is well established and a layer of organic matter has formed a surface mulch. It has been shown by Belgrave (*Malayan Agricultural Journal*, vol. XVIII, page 492) that on flat land at the Government Experimental Plantation, Serdang, no such loss occurred even during the early stages of growth. Typical analyses of leguminous and non-leguminous plants are appended. These can only, however, be taken as a rough guide, since variations may be expected owing to different conditions of growth at the time of sampling.

In the sections dealing with the use of various leguminous trees and herbs with individual crops, much useful information is adduced. The experience obtained with tea is of particular value, since many years of investigation in Ceylon must, of necessity, be of considerable assistance in the successful establishment of this new crop in Malaya. A large variety of leguminous plants are dealt with and provide a useful reference when such plants are under consideration in this country.

The illustrations are clear and serve a useful purpose in assisting the ready recognition of the various species described. An adequate index of the plants, and pests and diseases, referred to is appended.

J. N. M.

Departmental.

FROM THE DISTRICTS.

The Weather.

On the west of the main range very wet weather was experienced generally throughout the month. Heavy downpours resulting in floods occurred in Province Wellesley and Penang towards the end of the month. Similarly the rainfall over the greater part of Perak and Selangor was above the average. In west Pahang and in Kelantan the rainfall was about average for November.

Remarks on Crops.

Rubber. The price of rubber remained fairly constant throughout the month and was little changed from that given for last month. The wet weather hampered tapping in most districts and this was especially remarked upon in parts of Province Wellesley, Perak and Selangor. As usual, under such conditions, Mouldy rot was very much in evidence in all infected areas. Floods and strong winds experienced in Province Wellesley resulted in the uprooting of several hundreds of rubber trees in certain localities.

Padi. At the Bagan Serai Government Rice Mill the price of padi was the same as for last month namely \$1 80 per picul equivalent to about 7 cents a gantang. No appreciable change in the prices in other areas took place.

In parts of South and Central Kedah and in certain localities in the Bagan Tiang and Parit Buntar mukims of Krian, planting was still not quite completed at the end of the month. In these late planted areas only a poor or at least a medium crop can be anticipated. Damage by floods is reported from Balik Pulau District in Penang and from Province Wellesley South as well as from the Kulim District of Kedah and from Selama in Perak. In general, however, only minor damage has been sustained and reports from Province Wellesley indicate that the crop in many cases withstood temporary submergence with very little apparent damage. Crop prospects are generally good for North Kedah, Province Wellesley and most of Perak excluding Krian. In this important rice area prospects are variable. A good crop is expected to be produced in the mukims of Bagan Serai, Briah, Selinsing and Gunong Semanggol. The presence of very late planted areas in Kuala Kurau mukim and to a lesser extent in the Tanjong Piandang and Parit Buntar mukims, make prospects very uncertain in such areas. In the coastal areas of Kelantan harvesting was carried out very rapidly and was completed by about the middle of the month which was fortunate as heavy rain on the 20th flooded the harvested fields. In Selangor harvesting was completed in all the inland districts with the exception of Ulu Langat, and yields, on the whole, were moderately good, whilst in the coastal districts transplanting had just commenced. A good crop is anticipated in the Nggri Sembilan, and in Pahang the total crop is expected to be in excess of any yet recorded, partly on

account of a very considerable increase in the area planted.

Coconuts. A rather more detailed report than usual on the coconut position in the coastal districts of Selangor is provided this month by the Agricultural Field Officer. There has been a considerable falling off in yields generally during the past two months, especially in areas that are poorly drained. As a result of these small yields and the consequently, higher prices for nuts for copra manufacture, there has been no export of nuts to Ulu Selangor during the month with the result that supplies in that District are extremely short.

The present position regarding copra production by small holders may be roughly summarised. In Sabak Bernam there are approximately 150 kilns the majority of which are of a crude type. There are five manufacturers in this District who produce a high class quality of copra and efforts still continue to effect improvement in the poorly built kilns. In Kuala Selangor progress is well sustained. The owner of the first clay-walled kiln built at Jeram has started to convert this into a more substantial brick-walled kiln, whilst the owner of the large kiln at Api-Api is carrying out extensions in order to cope with the larger number of nuts he is now receiving. In Klang three out of fourteen of the Malay kilns are producing good quality copra. In Kuala Langat the building of kilns has been too rapid to allow of the proper Departmental supervision of their construction, with the result that there are a large number of inefficient kilns and only a few really satisfactory ones. Some improvement, however, has been effected, especially at Kanchong Darat and Batu where good average estate quality copra is now being produced. Efforts towards further improvement of the position are being continued. Progress towards the increased manufacture of copra by the small-growers themselves is reported from Province Wellesley, Bagan Datoh and Johore.

Agricultural and Padi Experiment Stations and Test Plots.

Kedah. The construction of a solar propagator was completed at Gajah Mati Agricultural Station

Perak. At the Titi Serong Padi Station heavy rain at the end of October caused considerable damage to recently planted, short maturation period padi. Similar damage was also reported to have taken place at Lenggong Test Plot where the area planted with Radin varieties was submerged on three occasions. At the Tanah Rata Experiment Station, Cameron Highlands, the pruning of the tea planted in 1931 and the ploughing of fields under variety trials has been completed.

DEPARTMENTAL NOTES.

Tour of the Director of Agriculture.

Dr. H. A. Tempany, Director of Agriculture, S.S. & F.M.S., made a tour of the Raub and Kuala Lipis Districts of Pahang and of the riverine areas from Jerantut to Temerloh, between the 9th and 13th of October. He was accompanied by the Agricultural Field Officer, Pahang.

Government Dairy and Poultry Farm, Fraser's Hill.

The livestock at the Government Dairy, Fraser's Hill, at the end of October, comprised 30 cows, 23 of which are in milk; 1 heifer, 1 stud bull, 1 young bull and 9 calves: a total of 42 animals. The stock, with the exception of one heifer calf which died of colic, was very healthy. During the latter part of October the calves were fed on separated milk to which was added 2.5 per cent. of palm oil in order to replace the deficiency of fat content: this new diet appeared to be highly satisfactory.

The poultry stock in October consisted of 60 pure bred, 12 cross bred and 8 native birds: 6 of the cross bred hens were imported from Seremban during the month.

Tobacco Curing at the Government Experimental Plantation, Serdang.

A flue curing barn for tobacco leaf was completed in October and an attempt to cure a small quantity of Virginia cigarette tobacco was made; although the barn was only about one quarter full, with the consequent difficulty of controlling the humidity of the air, a fair measure of success was obtained.

Mycological Division.

Among the other numerous activities of this Division, experiments were carried out on the pink mould (*Trichothecium sp.*) which is commonly found on copra after periods of rain, in order to determine whether it is injurious to the product. It was proved that this mould is incapable of penetrating the copra tissues and although numerous spores are produced, they do not appear to take any active part in copra deterioration.

Further research work was carried out on the fungoid diseases of oil palms, coffee, yams, tomatoes and several other minor crops. A site for an experimental bed for the culture of mushrooms was chosen at the Cheras Agricultural Station and arrangements were being made to carry out a series of experiments with the spawn obtained from a local species (*Volvaria volvaceae*).

Soil Survey in Pahang.

An area which has been proposed for the cultivation of padi at Triang Ilir, Pahang, a portion of which extends over the Negri Sembilan border, was visited in November by Mr. Wilshaw, Assistant Chemist, Soils with the object of

obtaining soil samples in order to determine its suitability for the growing of this crop.

Agricultural Shows at Kuala Selangor and Kajang.

An agricultural show was held for the first time at Kuala Selangor on November 10th, under the auspices of the Malayan Agri-Horticultural Association.

The exhibition embraced sections for vegetables, fruit, copra, padi, other minor economic crops, poultry and village industries. The quality and quantity of the peasant produce was very satisfactory. The excellence of some of the exhibits in the poultry section is deserving of special mention: the copra entries, on the other hand, were somewhat disappointing from so large a copra-producing district as Kuala Selangor.

Advantage was taken of the opportunity for educational propaganda by several Government Departments, notably by the Department of Agriculture which staged very instructive exhibits of copra and copra manufacture, methods of rat destruction and the cultivation of yams and other minor crops; other special exhibits were displayed by the Health, Infant Welfare and the Co-operative Departments.

A well attended Agricultural Show was also held at Kajang on the 13th. of November, comprising a representative display of the more important agricultural products of the District.

Bulletin of Malayan Agricultural Statistics.

This bulletin, which was published by the Department of Agriculture in November 1932, is the first of a new Economic Series; it comprises statistical information on the planted areas, production and exports of all the major economic crops together with the imports and exports of minor crops and other products closely related to agriculture.

A meteorological summary and a table showing the average annual prices in Singapore of the more important agricultural products between the years 1922 and 1931 is also included.

The bulletin is on sale at all booksellers and at the Department of Agriculture Kuala Lumpur at 50 cents per copy.

Supplement to Special Bulletin No. 83.

A supplement to Special Bulletin No. 38 "A Preliminary List of Food-Plants of Some Malayan Insects" was published by the Department on November 25th, 1932. This Supplement is published in a limited edition. Copies have been despatched to various institutions whose names are included on the exchange list of publications. This publication is of a technical character and owing to the present need for economy will not, therefore, be distributed to general subscribers except on application.

Appointment.

Mr. H. D. Meads has been appointed Temporary Assistant to the Deputy Registrar-General of Statistics, Kuala Lumpur, with effect from 1st October, 1932.

Leave.

Mr. F. W. South, Chief Field Officer, has been granted 9 months and 13 days leave on full pay, with effect from 23rd November, 1932.

Mr. F. Birkinshaw, Senior Agricultural Officer, Perak North, returned from leave of absence on 11th November, 1932, and will be acting in the capacity of Chief Field Officer during the absence of Mr. South.

Mr. F. de la Mare Norris, Principal Agricultural Officer, Johore, returned from leave of absence on 19th November, 1932.

Mr. T. A. Buckley, Assistant Chemist, returned from leave of absence on 17th November, 1932.

Retirement.

Mr. H. Ritchings, Horticultural Assistant, retires from the Government service with effect from 26th December, 1932, on the expiration of his present leave of absence, by reasons of the abolition of appointment under Section 8 (ii) (e) of the Pensions Enactment 1928.

Mr. H. T. Pagden, Assistant Entomologist, retires from the Government service with effect from 24th December, 1932, on the expiration of his present leave of absence, by reason of the abolition of appointment under Section 8 (ii) (e) of the Pensions Enactment 1928.

ERRATUM.**Seeding of *Derris Elliptica*.**

In line 16 of the article headed as above on page 582 of the November issue of this journal, for "2 ins." read "0.2 in."

Statistical.

MARKET PRICES.

November, 1932.

Rubber.—The Singapore price of rubber smoked sheet, equal to London Standard in November varied from 7 7/16 cents to 8 8/16 cents per lb., the average from the month being 7.75 cents as compared to 7.47 cents in October. The average London price was 2.56 d. per lb. as compared to 2.25 d. in October, while the New York average price was 3.39 gold cents per lb. as compared with 3.66 gold cents in the previous month.

Palm Oil.—The price of Palm Oil, c.i.f. Liverpool on a basis of 18 per cent. f.f.a. was quoted throughout the first three weeks of November at £18.10.0 per ton with a rise to £18.15.0 during the last week. The market was reported to be steady.

Copra.—The market in Singapore was quite steady during November the price varying from \$5.75 to \$5.90 per picul. The average prices per picul for the month were as follows:—Sundried \$5.81, mixed \$5.28 as compared with \$5.75 and \$5.20 respectively in October. Copra cake was quoted throughout November at \$2.10 per picul.

Coffee.—Singapore prices of Palembang coffee have varied but little during November, the average price per picul being \$19.38 as compared with \$19.56 for October. The average price of Sourabaya coffee was from \$24.50 to \$26.60 per picul as compared with \$24.19 to \$26.50 during the previous month, the price within this range depending upon quality.

Arccanuts.—The average Singapore price for Palembangs for November was \$2.64 per picul is compared with \$2.99 for October. Bila Whole averaged \$2.81 per picul as compared with \$3.24 in October. Average Singapore prices per picul of other grades in November were:—Splits \$4.31 to \$6.35; Red Whole \$4.88 to \$5.87; Sliced \$5.75 to \$8.75, the price within each range depending on quality. Kelantan Splits were unquoted.

Rice.—The following are the average wholesale prices per picul of rice in Singapore during October: Siam No. 2 \$3.68; Rangoon No. 1 \$3.41 as compared with \$3.86 and \$3.55 respectively in September.

The average retail market prices in cents per gantang of No. 2 Siam rice in October were:—Singapore 30, Penang 30, Malacca 28, as compared with 30, 30, and 27 respectively in September.

Gambier.—Prices in the Singapore market during November showed a tendency to decline. Average prices were:—Cube No. 1 \$10.19 per picul and Block \$5.88 per picul, as compared with \$10.94 and \$6.37 respectively in October.

Pincapples.—During November the Singapore market has been steady, the average prices per case were:—Cubes \$2.95, sliced flat \$2.84, and sliced tall \$3.24, as compared with \$3.07, \$3.01 and \$3.42 respectively in October.

Tapioca.—The Singapore market has been steady. Average prices per picul in November were :—Flake fair \$3.32, Pearl seed \$3.98 and Pearl medium \$4.08. Corresponding prices in October were \$3.32, \$4.04 and \$4.14.

Sago.—The average Singapore market prices per picul in November were :—Pearl, small, fair, \$4.07, Flour, Sarawak, fair \$2.29 as compared with \$4.15 and \$2.27 respectively in October.

Mace and Nutmegs.—The demand has been poor. Average prices per picul in Singapore were :—Siouw \$62, Amboina \$39.50 as compared with \$64 and \$41.25 respectively in October. Nutmegs 110 per lb. were \$23.75 and 80 per lb. \$29.50, the corresponding prices in the previous month being \$24 and \$33 per picul.

Pepper.—The average Singapore market prices per picul in November were :—Singapore Black \$17.75, Singapore White \$22.44, Muntok White \$22.94. Corresponding prices in October were \$18.31, \$24.06 and \$24.31.

Cloves.—Demand was poor, nominal prices only being quoted. The nominal prices per picul in Singapore throughout November were :—Zanzibar \$40, Amboina \$45, as compared with an average of \$40.75 and \$45.50 respectively for October.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur, and the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore.

1 picul = 133½ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London S.W.1.

GENERAL RICE SUMMARY*

October, 1932.

Malaya.—Gross foreign imports of rice (including stocks available for re-export) during October, 1932, amounted to 46,332 tons as compared with 55,768 tons in October, 1931, of which 55.1 per cent. were consigned to Singapore, 11.3 per cent. to Penang, 8.1 per cent. to Malacca, 17.2 per cent. to the Federated Malay States and 8.3 per cent. to the Unfederated Malay States.

Of these imports 71.4 per cent. were from Siam, 25.7 per cent. from Burma, 1.6 per cent. from French Indo-China and 1.3 per cent. from other countries.

Total foreign exports of rice from Malaya in October, 1932, were 17,486 tons (including 150 tons local production exported from Penang).

Of these exports 83.8 per cent. went to the Netherlands East Indies and 16.2 per cent. to other countries.

The exports during October 1931 were 15,787 tons.

Net Imports for the period January to October, 1932, were 335,184 tons as compared with 446,676 tons for the same period of 1931, a fall of 25.0 per cent

India and Burma—Total foreign exports of rice (*Indian Trade Journal* 10.11.32) during September, 1932, were 144,000 tons as compared with 113,000 tons in August, 1932, and 115,000 tons in September, 1931, increases of 27.4 per cent in respect of the previous month and 25.2 per cent. in respect of the same period of the previous year.

Total exports during period January to September, 1932, were 1,794,000 tons as compared with 1,671,000 tons for the corresponding period of 1931, an increase of 123,000 tons or 7.4 per cent

Total exports of rice and bran from Burma for the period January 1 to October 29, 1932, amounted to 2,699,093 tons as compared with 3,107,232 tons for the corresponding period of 1931, or a decrease of 13.2 per cent. Of these exports 776,023 tons went to India in 1932, as compared with 1,255,974 tons in 1931, a decrease of 38.2 per cent.

The second forecast of the rice crop in Burma for the season 1932-1933 issued on November 15, 1932, gives the area likely to mature as 12,339,000 acres, being 70,100 acres or 0.6 per cent. more than the final figures of last season.

Japan.—According to the first rice-crop forecast for 1932, the yield is estimated at 8,633,841 tons, an increase of 11.5 per cent. over the crop of 1931. The area planted is estimated to be 7,974,260 acres, a slight increase on that of the previous year.

Formosa.—The estimated production of rice this year is 680,432 tons, being 26.4 per cent. more than that of 1931. The area under rice is 942,689 acres, an increase of 6.2 per cent. as compared to that of last year.

Siam.—Exports (approximate) of rice from Bangkok during October, 1932,

* Abridged from the Rice Summary for October 1932, compiled by the Department of Statistics, S.S. and F.M.S.

amounted to 129,769 tons as compared with 96,000 tons in October, 1931 or an increase of 35.2 per cent.

Exports of rice from Bangkok during the period December 1931 to October, 1932, (the figures for August, September and October, 1932, being approximate) amounted to 1,369,504 tons, an increase of 282,567 tons or 26.0 per cent. as compared with the same period of 1930-31.

At the end of September 1932 the area under padi in the provinces of the inner circle amounted to 6,428,896 acres, a decrease of 2,736 acres from the area under this crop at the same time last year.

Netherlands India.—Java and Madura. The *Korte Berichten* of November 4, 1932, states that at the end of September, 1932, the area harvested amounted to 8,405,250 acres, an increase of 353,500 acres or 4.4 per cent. as compared with the same period of 1931, the area damaged to 337,391 acres a decrease of 115,881 acres or 25.6 per cent. as compared with 1931 and additional plantings awaiting harvest to 1,016,750 acres an increase of 84,000 acres as compared with 1931, a total of 9,759,391 acres as compared with 9,437,772 acres for the same period of 1931 an increase of 3.4 per cent.

Imports of rice into Java and Madura during January to September, 1932, totalled 113,800 tons as compared with 226,990 tons for the same period of 1931, or a fall of 49.9 per cent.

Imports of rice into Outer Provinces during January to August 1932, totalled 167,481 tons as compared with 224,907 tons for the same period of 1931 or a fall of 25.5 per cent.

French Indo-China.—Entries of padi at the port of Cholon from January 1, 1932, to October 27, 1932, amounted to 968,606 (metric) tons, an increase of 4,315 tons or 0.4 as compared with the same period of 1931.

Exports of rice from Saigon for the period January 1, 1932, to October 31, 1932, amounted to 988,591 (metric) tons an increase of 146,617 tons or 17.4 per cent. as compared with the same period of 1931.

Ceylon.—Imports for 9 months September 30, 1932, were 339,023 tons, an increase of 8,799 tons or 2.7 per cent. as compared with 1931.

Of these imports 20.4 per cent. were from British India, 70.2 per cent. from Burma, 0.3 per cent. from the Straits Settlements and 9.1 per cent. from other countries (Cochin-China, Siam, etc.).

Europe and America.—During the period January 1st to October 20th, 1932, 862,337 tons were shipped from the East to Europe, as compared with 962,380 tons for the same period of 1931. Of the 1932 shipments 54.7 per cent. were from Burma and 34.9 per cent. from Saigon.

For the period January 1st to September 20th, 1932, 45,325 tons were shipped from the East to the Levant, a decrease of 17.1 per cent. as compared with the same period of 1931.

To the West Indies and America for the period January 1st to September 7th, 1932, 102,094 tons were shipped from the East, a decrease of 17,711, or 14.8 per cent. as compared with the corresponding period of 1931.

MALAYAN AGRICULTURAL EXPORTS, OCTOBER, 1932.

PRODUCT.	NET EXPORT IN TONS.				
	Year 1931	Jan-Oct 1931	Jan-Oct 1932	October 1931	October 1932
Arecanuts ...	19,266	16,113	16,121	1,319	680
Coconuts fresh ...	10,468	7,149½	100,607†	984½	10,637†
Coconut oil ...	9,909	8,129	9,212	717	1,080
Copra ...	100,809	79,580	78,147	8,752	12,196
Gambier, all kinds .	2,563	2,203	2,546	279	142
Palm kernels ...	726	554	973	143	130
Palm oil ...	4,574	3,465	6,290	711	892
Pineapples Canned ...	59,457	49,127	56,703	2,011	2,239
Rubber ..	434,857	356,402	342,132	37,474	36,621
Sago—flour ...	5,608	2,001	7,478	2	916
„ —pearl ..	2,429	1,875	2,716	267	580
„ —raw ...	2,904*	1,758*	3,330*	307*	302*
Tapioca—flake ...	9,742	8,276	7,846	577	653
„ —flour ...	491*	267*	112*	158*	79
„ —pearl ...	19,006	15,936	16,564	1,614	1,193
Tuba root	74	48	105½	3½	7½

† '000 in number.

* net imports.

ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING IN
NETHERLANDS INDIA AT THE END OF SEPTEMBER 1932.

	A Totally Ceased		B Partly Ceased		Total A & B	
	Estates	Area in acres	Estates	Area in acres	Estates	Area in Areas
Java and Madoera ...	227	139,683	46	15,593	273	155,276
Outer Provinces ...	210	93,494	59	28,911	269	122,405
Netherlands India ...	437	233,177	105	44,504	542	277,681

The total area for September amounts to 29 per cent. of the total tappable area as at the end of December 1931.

Received by the Statistics Department from the Central Bureau of Statistics, Batavia.

**ACREAGE OF TAPPABLE RUBBER OUT OF TAPPING ON ESTATES OF 100
ACRES AND OVER, MALAYA, AT THE END OF OCTOBER, 1932.**

STATE OR TERRITORY	ACREAGE OF TAPPABLE RUBBER end 1931	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING		Total (3) + (5)	Percentage of (7) to (2)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)		
FEDERATED MALAY STATES :—							
Perak	238,420	14,662	6.1	32,062	13.4	46,724	19.6
Selangor	294,030	17,703	6.0	37,685	12.8	55,388	18.8
Negri Sembilan	217,002	20,060	9.2	20,819	9.6	40,879	18.8
Pahang	35,122	8,122	23.1	4,419	12.6	12,541	35.7
Total F.M.S.	784,574	60,547	7.7	94,985	12.1	155,532	19.8
STRAITS SETTLEMENTS :—							
Province Wellesley	44,055	3,229	7.3	8,699	19.7	11,928	27.1
Dindings	6,700	504	7.5	1,205	18.0	1,709	25.5
Malacca	110,288	5,054	4.6	21,771	19.7	26,825	24.3
Penang Island	1,585	776	49.0	54	3.4	830	52.4
Singapore Island	28,033	13,014	46.4	3,981	14.2	16,995	60.6
Total S.S.	190,661	22,577	11.8	35,710	18.7	58,287	30.6
UNFEDERATED MALAY STATES :—							
Johore	313,385	43,127	13.8	34,867	11.1	77,994	24.9
Kedah (a)	114,254	11,114	9.7	7,112	6.2	18,226	16.0
Kelantan	16,785	6,808	40.6	1,181	7.0	7,989	47.6
Trengganu (b)	4,300	Nil	Nil	2,072	48.2	2,072	48.2
Perlis	903	106	11.7	462	51.2	568	62.9
Total U.M.S.	449,627	61,135	13.6	45,694	10.2	106,849	23.8
TOTAL MALAYA	1,424,862	144,279	10.1	176,389	12.4	320,668	22.5

Notes :—1. (a) Registered companies only and are rendered quarterly, commencing with June 1931.

(b) Registered Companies only.

The above table together with a Summary was prepared and published by the Statistics Department, S.S.
and F.M.S. on October 26, 1932.

TABLE I
MALAYA RUBBER STATISTICS
STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX,
FOR THE MONTH OF OCTOBER, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by estates of over 100 acres and over estimated 2			Imports			Exports including re-exports			Stocks at end of month		
	Dealers	Ports	Estates of 100 acres and over	during the month	during the month	during the month	during the month	From Straits Settlements	From Federated Malay States	Foreign	Local	Foreign	Local	Dealers	Ports
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
MALAY STATES:—															
Federated Malay States
Johore
Kedah
Perlis
Kelantan
Trengganu
Total Malay States
SEMITES															
Malacca
Province Wellesley
Dindings
Penang
Singapore
Total Straits Settlements
TOTAL MALAYA

TABLE II
DEALERS' STOCKS, IN DRY TONS

Class of Rubber	Fed-erated Malay States			Pro-duce of Penang			Pro-duce of Malacca			Total		
	21	22	23	24	25	26	27	28	29	30	31	32
DRY RUBBER	12,158	15,376	3,819	8,557	1,128	36,038	...	...	...	...	...	...
WET RUBBER	2,881	2,780	467	271	1,703	8,102	...	...	...	...	...	...
TOTAL	15,039	18,156	4,286	8,828	2,831	44,140	...	...	...	...	...	...

TABLE III
FOREIGN EXPORTS

Ports	For month		For month	
	1932	1931	1932	1931
Singapore	23,865	24,771
Penang	8,397	91,279
Port Swettenham	4,138	50,577
Malacca	1,531	8,468
MALAYA	31,931	39,095

TABLE IV
DOMESTIC EXPORTS

Area	For month		For month	
	1932	1931	1932	1931
Malay States	80,735	140,356
Straits Settlements
MALAYA	80,735	140,356

Notes.—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.

2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month. + Consumption. i.e., Columns [18] + [14] + [17] + [18] + [19] + [20] + [21] + [22] + [23] + [24] = [25]—[10]—[11]. For the Straits Settlements, Columns [7] + [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; concentrated latex, 50%; revertex, 50%. The average monthly dry weight of foreign imports are reduced to dry weights by the same ratios.

4. Downward movement of stocks is estimated by deducting the average monthly dry weight of foreign imports from the total stocks at the beginning of the month. The stocks at the end of the month are then estimated by deducting the average monthly dry weight of foreign imports from the total stocks at the beginning of the month.

5. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 21st October, 1932.

Locality	AIR TEMPERATURE IN DEGREES F HENKHEI										EARTH TEMPERATURE		RAINFALL						BRIGHT SUNSHINE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
	Means of		Absolute Extremes				Mean of A and B		At 1 foot		At 4 feet		Total		Most in a day		Precipitation		Thunder-storm		Fog morning obs.		Gale force 8 or more	Per cent																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	A.	B.	Max.	Min.	°F	°F	°F	°F	°F	°F	in.	mm.	in.	Amt.	Precipitation .01 in or more	Precipitation .05 in or more	Precipitation .10 in or more	Precipitation .15 in or more	Precipitation .20 in or more	Precipitation .25 in or more	Precipitation .30 in or more	Precipitation .35 in or more			Precipitation .40 in or more	Precipitation .45 in or more	Precipitation .50 in or more	Precipitation .55 in or more	Precipitation .60 in or more	Precipitation .65 in or more	Precipitation .70 in or more	Precipitation .75 in or more	Precipitation .80 in or more	Precipitation .85 in or more	Precipitation .90 in or more	Precipitation .95 in or more	Precipitation 1.00 in or more	Precipitation 1.05 in or more	Precipitation 1.10 in or more	Precipitation 1.15 in or more	Precipitation 1.20 in or more	Precipitation 1.25 in or more	Precipitation 1.30 in or more	Precipitation 1.35 in or more	Precipitation 1.40 in or more	Precipitation 1.45 in or more	Precipitation 1.50 in or more	Precipitation 1.55 in or more	Precipitation 1.60 in or more	Precipitation 1.65 in or more	Precipitation 1.70 in or more	Precipitation 1.75 in or more	Precipitation 1.80 in or more	Precipitation 1.85 in or more	Precipitation 1.90 in or more	Precipitation 1.95 in or more	Precipitation 2.00 in or more	Precipitation 2.05 in or more	Precipitation 2.10 in or more	Precipitation 2.15 in or more	Precipitation 2.20 in or more	Precipitation 2.25 in or more	Precipitation 2.30 in or more	Precipitation 2.35 in or more	Precipitation 2.40 in or more	Precipitation 2.45 in or more	Precipitation 2.50 in or more	Precipitation 2.55 in or more	Precipitation 2.60 in or more	Precipitation 2.65 in or more	Precipitation 2.70 in or more	Precipitation 2.75 in or more	Precipitation 2.80 in or more	Precipitation 2.85 in or more	Precipitation 2.90 in or more	Precipitation 2.95 in or more	Precipitation 3.00 in or more	Precipitation 3.05 in or more	Precipitation 3.10 in or more	Precipitation 3.15 in or more	Precipitation 3.20 in or more	Precipitation 3.25 in or more	Precipitation 3.30 in or 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more	Precipitation 29.15 in or more	Precipitation 29.20 in or more	Precipitation 29.25 in or more	Precipitation 29.30 in or more	Precipitation 29.35 in or more	Precipitation 29.40 in or more	Precipitation 29.45 in or more	Precipitation 29.50 in or more	Precipitation 29.55 in or more	Precipitation 29.60 in or more	Precipitation 29.65 in or more	Precipitation 29.70 in or more	Precipitation 29.75 in or more	Precipitation 29.80 in or more	Precipitation 29.85 in or more	Precipitation 29.90 in or more	Precipitation 29.95 in or more	Precipitation 30.00 in or more	Precipitation 30.05 in or more	Precipitation 30.10 in or more	Precipitation 30.15 in or more	Precipitation 30.20 in or more	Precipitation 30.25 in or more	Precipitation 30.30 in or more	Precipitation 30.35 in or more	Precipitation 30.40 in or more	Precipitation 30.45 in or more	Precipitation 30.50 in or more	Precipitation 30.55 in or more	Precipitation 30.60 in or more	Precipitation 30.6

Compiled from Returns supplied by the Meteorological Branch, Malaya.

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